THE TOOL ENGINEER

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

Behind every manufactured product is the tool engineer

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Another Cost-Cutting Application of These Amazing P&W Tools

Notoriously tough to cut — stainless steel has always presented finishing headaches. But today many shops have found the answer to their problems with P&W Keller Carbide Burs.

In the picture at right a Keller Shape P Bur (just 1 of the 53 types available) wades into welds on a stainless milk cooler. Excess metal is cleaned up far faster than by conventional methods and the resulting finish is comparable to fine grinding.

Such jobs are typical of the time and money-saving applications that are making P&W Keller Carbide Burs increasingly popular with production men all over the country.

For with these machine-ground, super-efficient burs you can alter dies hardened up to 65 Rockwell C and cut at an amazing speed through cast iron. More than that, they'll outlast ordinary steel burs 75 to 1 and up. When finally worn dull they can be returned to us and resharpened like new — ready to start work all over again.

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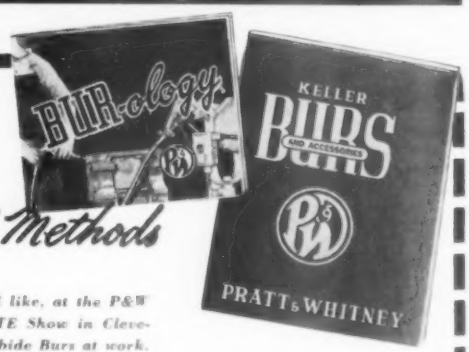

You may pick up your copies, if you'd like, at the P&W Kellerflex booth, No. 1612, at the ASTE Show in Cleveland. Plan to stop in . . . See P&W Carbide Burs at work.

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Official Publication: American Society of Tool Engineers

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Feb., 1948

Vol. XX, No. 1

Editorial

Accelerating Industrial Progress

BY PRESENTING AND ATTENDING the Tool Engineers Industrial Exposition next month, members of the American Society of Tool Engineers are making a doubly significant contribution to American industry. Coming at a time when industry is doing its utmost to improve its productive facilities to provide the high-level flow of goods which seems the only solution to vital economic problems at home and abroad, the Exposition will offer tool engineers and others responsible for production an unusual opportunity to review and preview the latest technique destined to increase both production and employment.

Assembled in Cleveland's Public Auditorium the week of March 15-19 will be a tremendous array of the newest and most efficient tools and machines as well as educational presentations of the latest processes, methods and techniques for cutting costs and improving quality in every field of metal working. The country's leading manufacturers will be represented.

This huge industrial fair might be considered as an educational laboratory. Here visiting engineers, technicians and industrialists will have an opportunity to see the latest in tools and processes at close range. They will observe them in actual operation and discuss their merits and advantages with the builders. They will seek the advice of manufacturers as to which products will fill their special needs, and compare at one showing the products offered by competing manufacturers.

Word-of-mouth advertising and education has always been the most effective way of creating lasting impressions, chiefly because personal conviction can always be best conveyed through conversation and personal contact. Added to this is visual appeal and actual demonstration of products on a comparative basis, which makes the trade show the best setting possible for carrying out such advertising and merchandising on a large scale.

But, we as a Society, must consider above all else the educational implications of this, the seventh ASTE sponsored show. It portends to be the largest trade show of the year in the industrial field, and because of the nature of the field it covers, one of the most important from the viewpoints of both the exhibitor and visitor.

In addition to knowledge which will be gained from viewing the Exposition, the tool engineer will have the opportunity to hear outstanding experts in the various branches of his specialized field of engineering. These authorities will appear on the technical seminars which are featured on the program of the ASTE Sixteenth Annual Meeting, held concurrently. A third education advantage will be gained by visiting various industrial plants, which have been especially selected because of recent innovations in manufacturing techniques.

Tool engineers are key men in the modern production setup. It is, therefore, the aim of the Society in this combined Exposition-Convention to acquaint them and other industrial leaders with new developments which will help them do the job that recent economic changes dictate. It is a known fact that an alarming number of machines and methods which figured so importantly in our wartime productivity are now obsolescent. This Exposition will offer the first opportunity for tool engineers and other production men to see the postwar developments and to determine how they may be profitably applied to their own operations.

It is a generally accepted fact that one of the tool engineer's most important duties is that of buying, recommending and specifying the tools and machines which increase production, raise quality standards, and lower costs. The knowledge he can gain by attending the ASTE Exposition will enable him to better and more efficiently perform this important task.

Every tool engineer owes it to himself, his company and the world society in which he lives to attend the Exposition and the technical meetings. It is a part of his responsibility in America's fight to increase and thereby help achieve and maintain world-wide economic stability.

W. B. Peirce

President 1947-48

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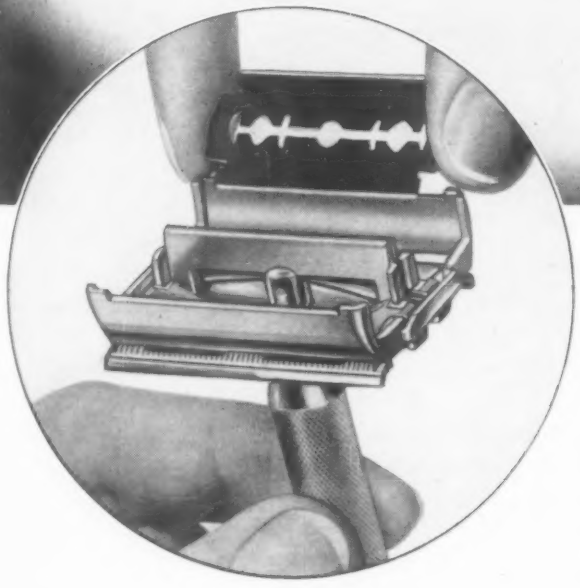

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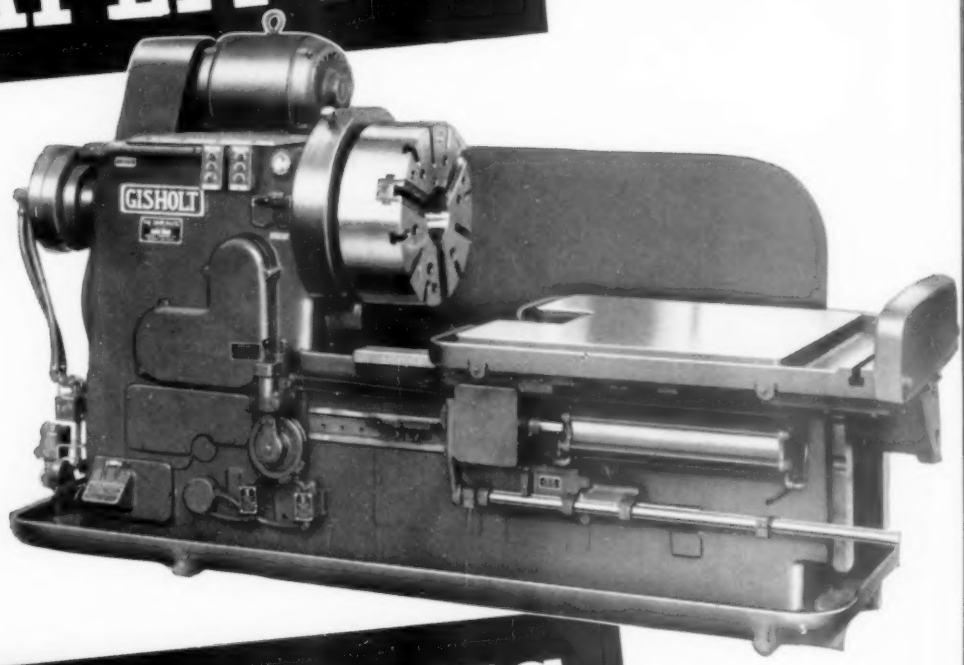

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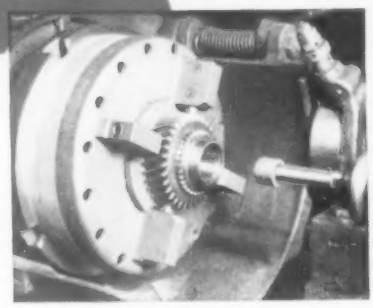

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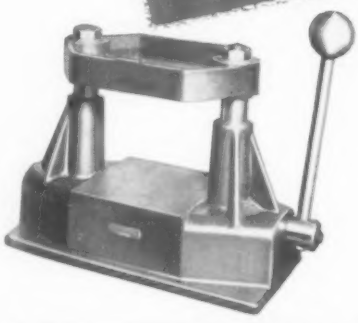

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In multiple spindle drilling and tapping, save time and money; eliminate trouble and delays; adjust drills and taps fast and easy as One, Two, Three.

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For complete information refer to page 38, and 64 through 78 of Scully-Jones Tool Engineering Manual 500, or write for details.

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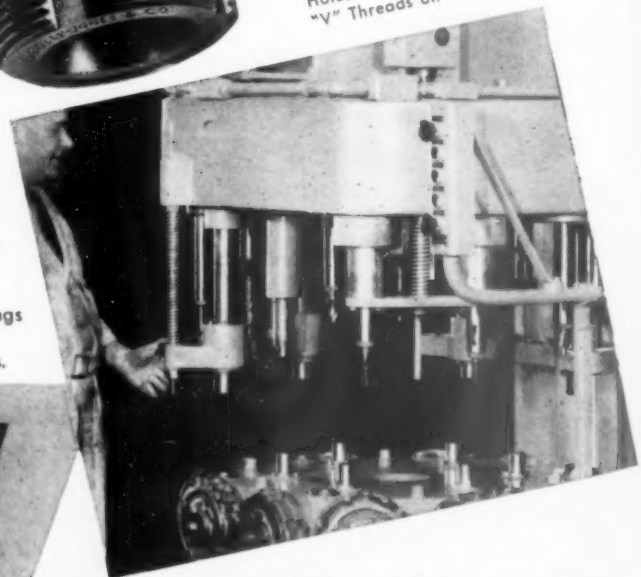

TYPICAL APPLICATION—of Scully-Jones Adjustable Adapter Type Assemblies. Close-up of work head and index table of a Special Multiple Spindle Machine, Manufactured by The Cross Co., Detroit, Mich.

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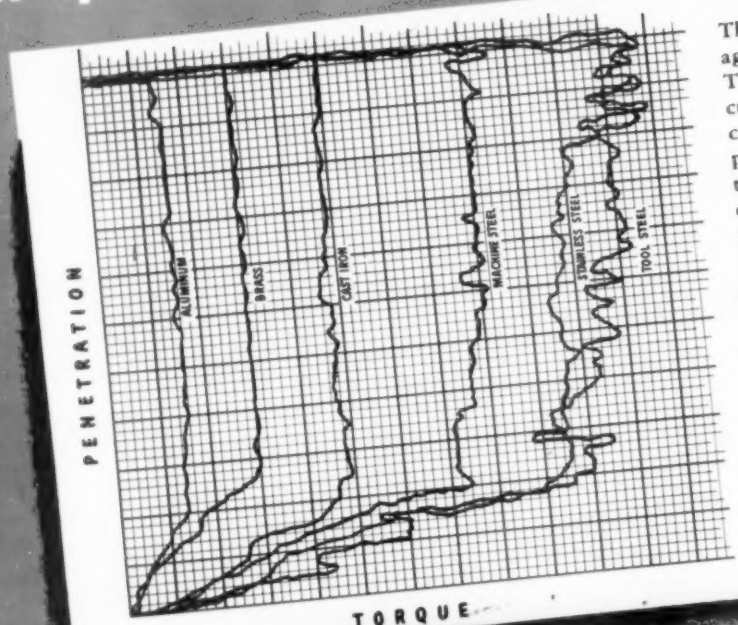
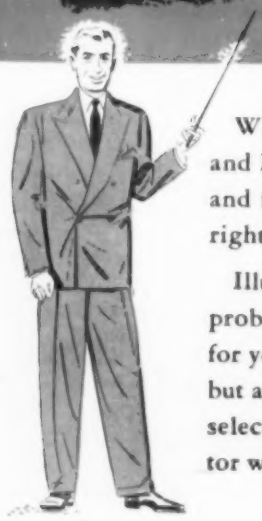
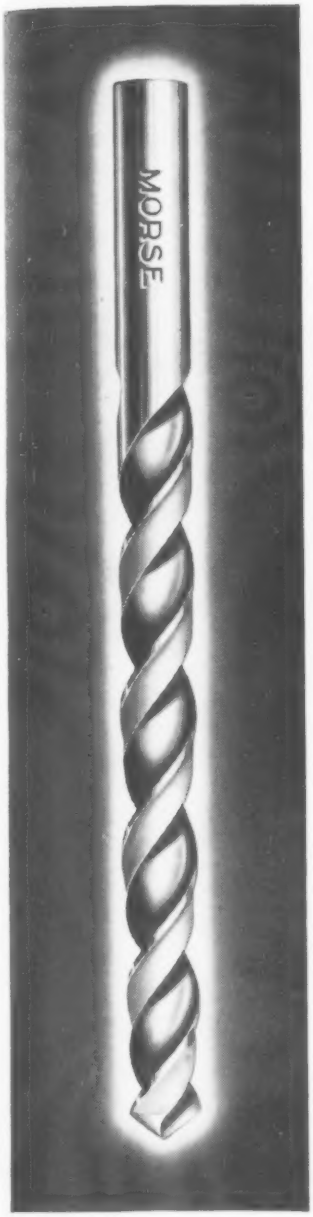


This chart shows drill penetration against torque in various metals. The curves are typical of a *series* of curves in similar tests. They indicate the performance of a special purpose drill as the design is altered for maximum cutting efficiency. Many "trial and error" tests preceded the one that produced the results shown and many other tests followed before the final design was approved. The high speed steel from which the drill is made, the helix angle, web thickness, heat treatment and angle of point are all variables that are studied and re-studied. This testing is typical of the continuous checking by the Morse Laboratory to develop drills that offer the best performance for special jobs.

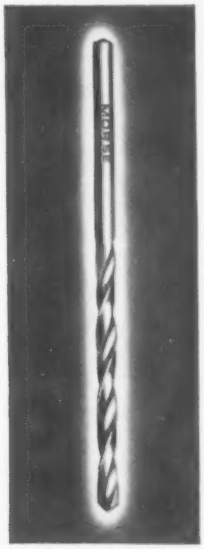


When *special* drilling problems prove troublesome, look to the Morse Laboratory and Morse engineering to meet the need in terms of *special purpose* drills. Morse skills and facilities *plus* long experience in the production of cutting tools that have proved right, is your assurance of the best working tool for *your* job.

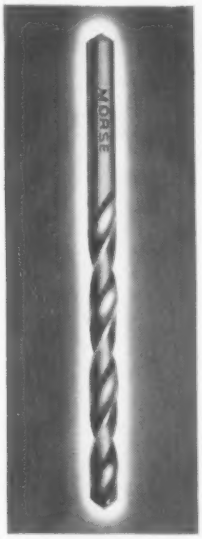
Illustrated are five special purpose drills that have supplied the answers to challenging problems by cutting *faster* and lasting *longer*. Perhaps one or more of them is designed for you. But remember, *your* production may vary enough to require seemingly similar but actually quite different specifications. That is why we say let Morse lend a hand in selecting the drill that will do the superior job for *you*. Your Industrial Supply Distributor will be glad to help.



MORSE **Quick-Twist Drills (1363)** . . . for deep-hole drilling in aluminum, magnesium, die-cast metals; for slate, marble and certain plastics.



MORSE **Cotter-Pin Drills (1386)** . . . for skin metal, shallow-hole drilling, cotter-pin holes, steering arms, knuckles, gas burners and copper. Ideal in portable drills.



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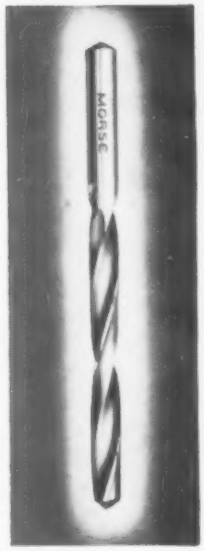
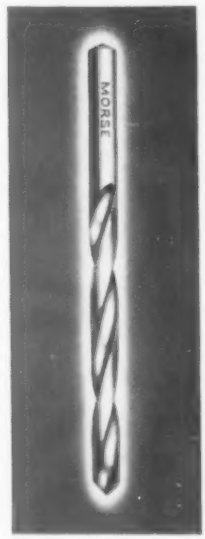


MORSE **Brass Drills (1344)** Specially designed for work in brass. Made with wide grooves to clear chips easily. Special slow spiral.



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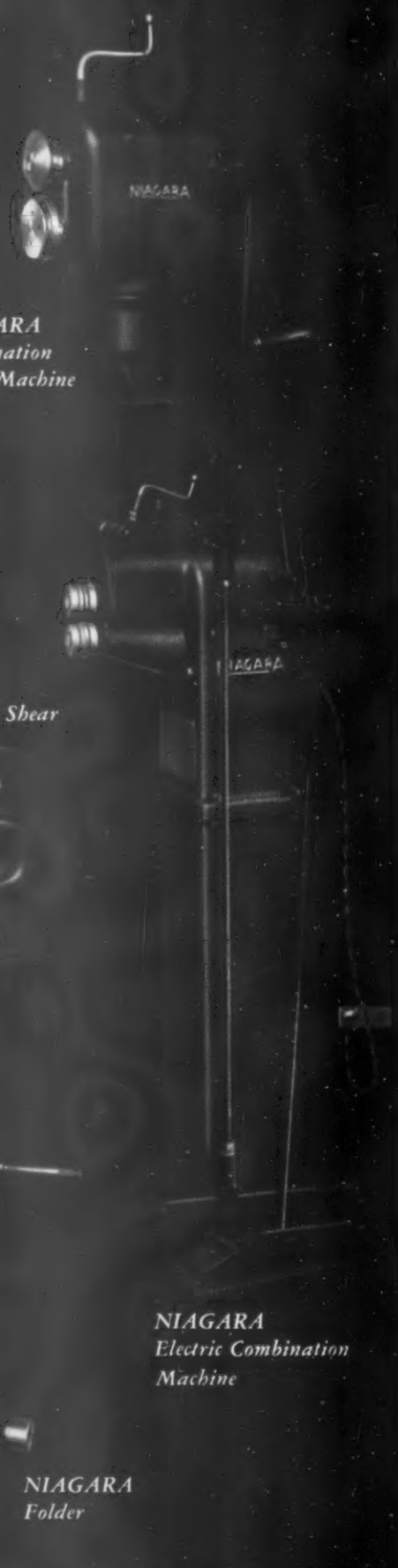

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Combines extreme strength with the quick change features of the pin drive. Developed especially for heavy cuts.

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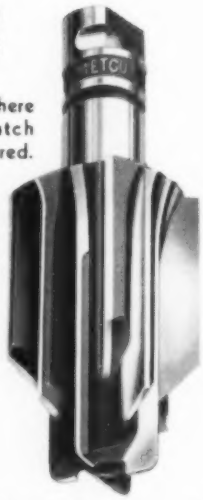

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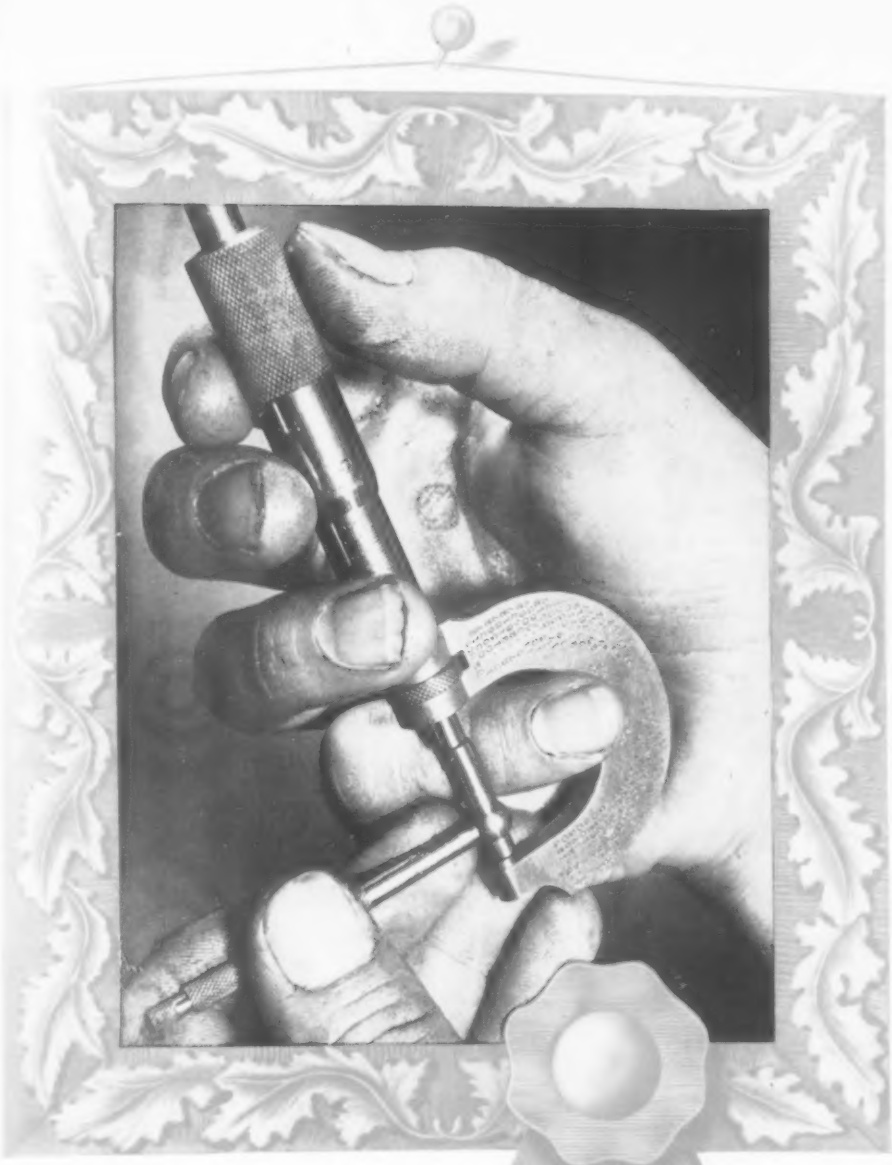

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Winning Combination

"HANDS" by Robert Comport is a prize-winning photographic study selected for excellence of detail. A stickler for accuracy, Mr. Comport chose as his model a craftsman whose sensitive hands reflect years of painstaking labor on precision work. And to complete the picture, he chose Starrett Tools—the tools skilled craftsmen use. Shown in the photographic study are: Starrett Micrometer No. 230 and Starrett Telescoping Gage No. 229.

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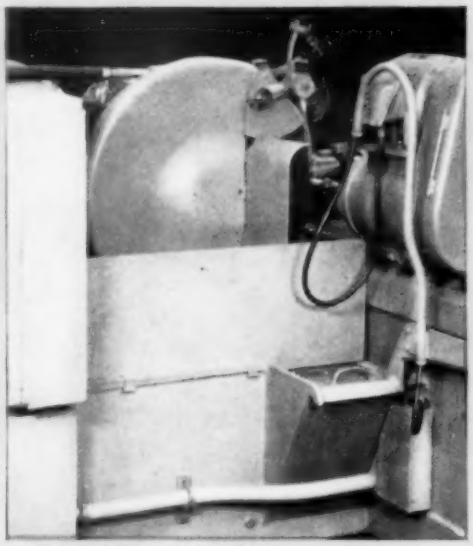
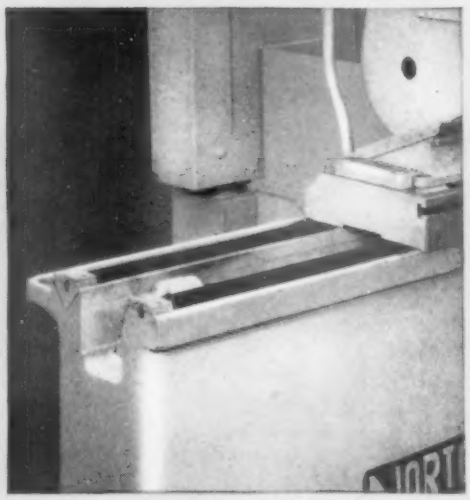
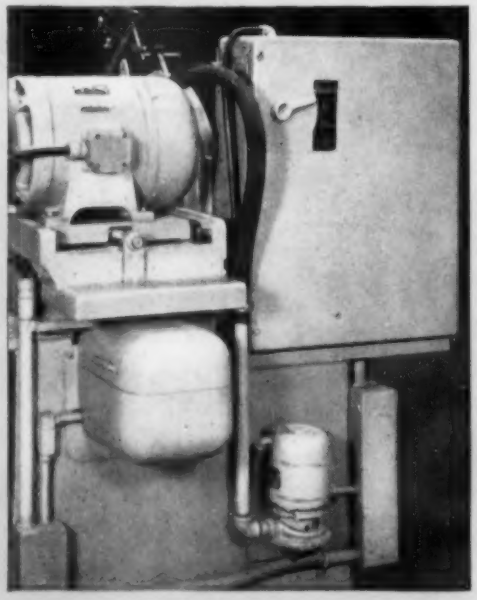


Rear base design offers maximum accessibility to hinged guard for wheel change. Note ramped outlet for easy sludge removal.



Steel ribbon type guards provide complete protection of base ways and reduce grit infiltration. Neat and compact, they require no extra floor space, and allow a more rigid table design.



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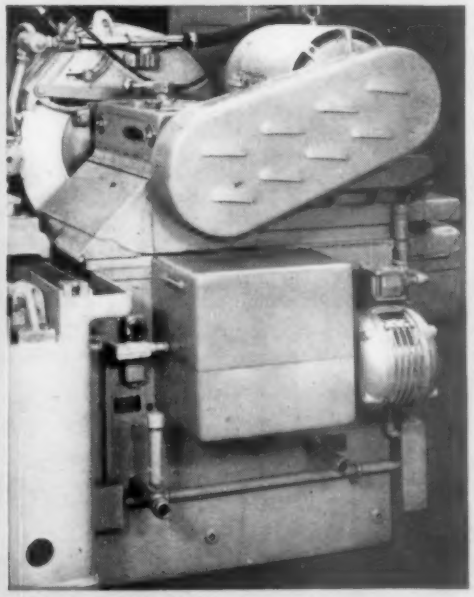

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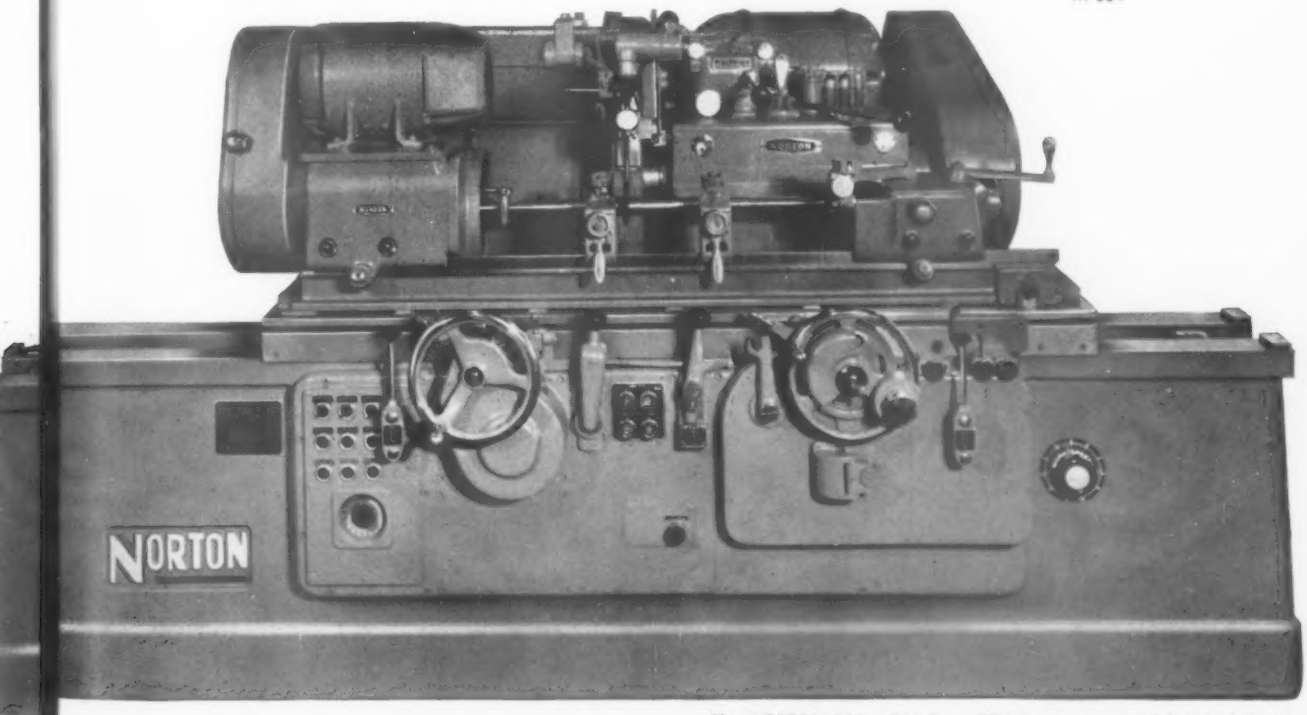

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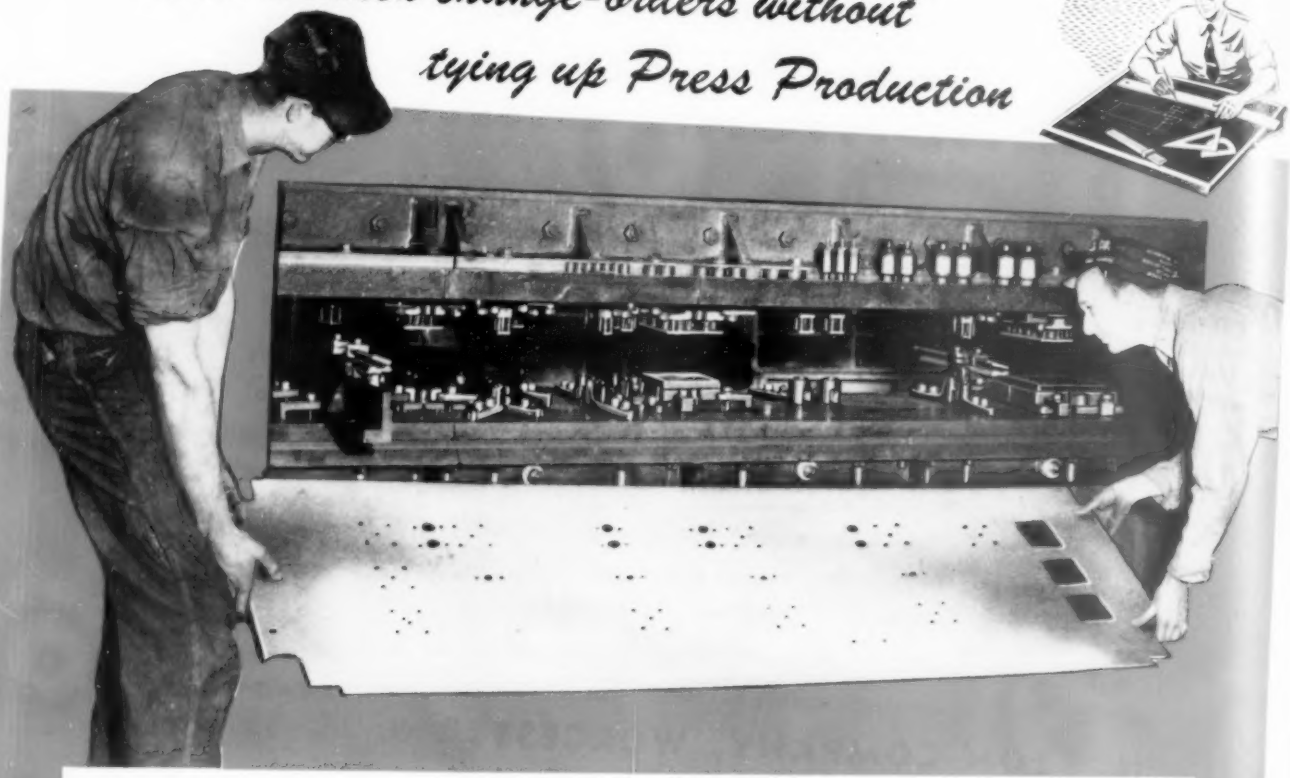

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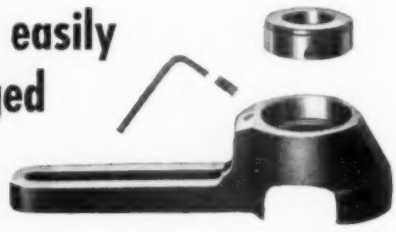

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Job Planning on the Turret Lathe

by E. L. Murray

Rising Production Costs Must Be Balanced With Efficient Tooling

Part One of Two Installments

RISING PRODUCTION COSTS are a growing problem to Factory Management who must continually balance them with sales and profit limitations for success in business. In the production cost of many articles, the efficiency of machine tool operation and job planning are major factors, and since few machine tools are so strategically situated in the total processing of machined parts as the horizontal turret lathe, it is well to frequently examine the use of this machine as a basic measure of cost control.

A native of Cleveland, Ohio, *Edward L. Murray* was graduated from Purdue University with degree B.S. in M.E. Joining the Warner & Swasey Company about 12 years ago, he was assigned to tool testing, design and estimating and, during the late war, as Field Engineer working directly with W & S customers. He is now in charge of Turret Lathe Job Estimating and, as a member of the ASME, serves on the Special Research Committee on Metal Cutting.

It is the purpose, therefore, to show herein some of the elements in job planning on the horizontal turret lathe, and how the proper application can result in acceptable work at a cost compatible with production requirements. By virtue of design, the modern horizontal turret lathe—hereinafter referred to simply as turret lathe—is an extremely flexible shop tool and can be included in the routing of jobs of all sizes, shapes, machining characteristics and tolerances over a wide range of lot size requirements. This very flexibility, however, often defeats its value where preplanning and full recognition of the fundamentals of turret lathe practice are not observed.

Fundamentals of Turret Lathe Practice

The fundamentals of Turret Lathe Practice can be considered as having five phases, (1) Outline of tooling method, (2) Types of durable and perishable tools, (3) Selection of type and size machine, (4) Use of machine elements, and (5) Maintenance of machine accuracies by proper care, cleaning and lubrication. Each of these phases may be developed briefly as follows:

1. OUTLINE OF TOOLING METHOD. Lot sizes and their repeat cycle will always affect tooling method. For example, by using the least expensive tooling for small lots, a medium size, single groove vee belt sheave might be held in standard chuck jaws and rough and finish bored and reamed in three hexagon turret stations, whereas the cross slide cutters would rough and finish turn, groove, and face both sides of the flange and one side of the hub in five stations.

With special tools for large lots, special chuck jaws would permit heavier feeds and speeds through better gripping. Rough and finish turning and boring, slab facing of the hub and reaming would be done from the hexagon turret in two stations. Straddle facing of the flanges and grooving would be done in two stations on the cross slide. Compare eight cutting stations for the simplified tooling to four stations with special tooling.

Between these extremes is a place for the permanent arrangement of rugged, quickly adjustable, Universal Standard Tools—available today from most turret lathe manufacturers—which can minimize setup time to cover small lots and yet are flexible enough to reach into the field of special tools, with the added advantage that their cost can be spread to cover most of the jobs produced on the machine. For these reasons, the standard Universal Bar and Chucking Tools should be considered minimum equipment for any turret lathe.

Additional factors affect the outline of tooling method, as, for example, workpiece accuracy, finish, shape, material and stock allowance. In removing surplus metal, the number of cuts taken on any surface should be sufficient to hold tolerances without excessive gaging time due to cutter wear. Close concentricities, or workpiece geometry, may demand special holding devices.

2. TYPES OF DURABLE AND PERISHABLE TOOLS. It seems superfluous to criticize the use of 5 HP tools on a 40 HP turret lathe; yet, this happens all too often. Cross slide cutter blocks should be rigid and designed for ample support under the cutter. Hexagon turret tool holders should be piloted, where feasible, for roughing cuts. The cross section of all types of cutters should be as great as possible. Cutting tools should be adjustable to compensate for wear and for workpiece and machine tool instability. Cutting tools should also be selected with due regard for the job. There is still no one best cutting tool. High speed steel, the cast alloys, cemented carbide and others all have individual applications for which they are particularly suited. Any one job might include more than one type.

3. SELECTION OF TYPE AND SIZE MACHINE. Not every job that will swing on a certain size turret lathe belongs on that machine. Turret lathes are available, today, with a wide range of collet capacities for bar stock work and swing capacities for chucking work. Usually some overlapping of such capacity exists between machines, necessitating a consideration of other factors:

(a) Will the stroke required by hexagon turret tools permit the use of ramtype or of saddle type machines?

(b) Will the increasing overhang of the ram type turret slide as the cut progresses prove harmful, or should the constant overhang of the sliding saddle machine be selected?

(c) Does the job call for a power feed cross slide or will a hand operated slide be allowed?

(d) Does the nature of the job require a geared head turret lathe which offers numerous speed selections, or should a gearless head turret lathe be used? Perhaps, in this latter case, the axis of the spindle must be held in line with the axis of the cutting tools for close boring; head

gears and clutches working in oil create heat and therefore non-uniformity in spindle position.

(e) Is the speed of the machine correct? And (f) is the required power available? Turret lathes are equipped with drive motors from 3 to over 40 HP. A 2:1 ratio, two-speed motor is frequently desirable. It allows push-button speed shifting and, by virtue of running the drive shaft at faster than standard speeds, permits the use of larger than standard drive motors without exceeding the capacity of the headstock.

(f) Are tool clearances available? Will a die head swing over the cross slide and over the top of the ram when indexing the turret? Will the swing over the cross slide horn on saddle type machines permit "parking" of the square turret behind the workpiece to reduce the overhang of hexagon turret tools?

(g) If two machine sizes and types seem acceptable in all other respects, handling time may be a consideration. Some sizes of ram and saddle type machines have equivalent workpiece capacity; yet, handling time on the saddle machine may be double that on its counterpart.

4. USE OF MACHINE ELEMENTS. Machine elements are parts of the machine; for example:

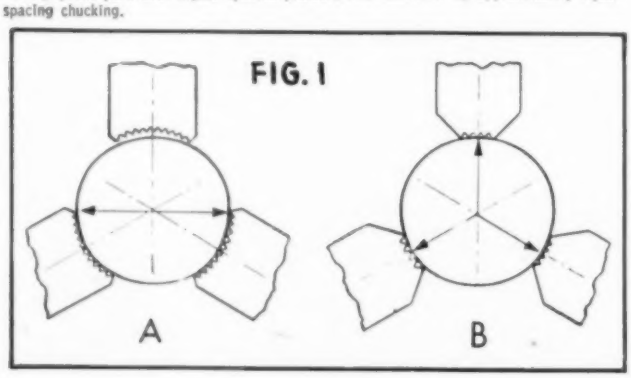
(a) The saddle of a ram type machine should be clamped to the bed so that minimum turning of the ram turnstile handles is required to advance the hexagon turret, yet be clamped far enough away from the work so that long drills, boring bars, and other extended tools clear during indexing.

(b) Tools on the hexagon turret should be arranged to minimize head gear speed shifting. (c) Tools on the hexagon turret should be arranged in multiple where possible and in relation to the cross slide tools, so that these multiple cuts can be taken in combination with the cross slide cuts. (d) Machine stops should be set.

5. MAINTENANCE OF MACHINE ACCURACIES BY PROPER CARE, CLEANING, AND LUBRICATION. A turret lathe is a precision tool and as such deserves normal respect. Collet chuck and scroll chuck accuracies can be preserved by frequent cleaning. All other exposed wear surfaces should be cleaned by wiping with a lint-proof rag and not by the use of an air hose. Ram type turret slides and saddles should be taken apart and cleaned occasionally, particularly if exposed to cast iron dust or brass chips.

Heavy castings or forgings should not be rested upon finished machine surfaces, nor should the hexagon turret be abused by violent or showy indexing. Lapping compound or grinding attachments should not be used on the turret lathe unless special precautions are taken to remove their by-product. Finally, lubrication schedules should be followed as faithfully in succeeding years as during the first year.

FIG. 1. Chuck jaws at "A" are too wide—workpiece may hang between directly opposing points on jaws, thus not centering properly. Although narrower, jaws at "B" grip the part with higher specific pressure and centralize by approximately equal spacing chucking.



Tooling Principles

Tooling principles that may be concluded from the above Fundamentals of Turret Lathe Practice are:

1. Do not be satisfied necessarily with the setup previously in use.
2. Total time for the job should be kept at a minimum by balancing setup time, work handling time, machine handling time, and cutting time.
3. Reduce setup time by using Universal Tooling Equipment and by arranging the heavier flanged type tools in a logical order and keeping them in a permanent setup.
4. Keep work handling and chucking costs down by selecting proper standard equipment and by using special equipment when it is justified by large lot quantities and savings to be made.
5. Reduce machine handling time by using the right size machine for the job and by taking as many multiple cuts as possible.
6. Reduce cutting time by (a) Multiple cuts, (b) Combined cuts, (c) Increased feeds through rigid tooling, and (d) Increased speeds by use of proper cutters.

Importance of Time Element

As stated previously, any machining operation is a combination of machine tool operation and job planning. The fundamentals of turret lathe practice and their corollary tooling principles relate the operation of the machine tool to the job. For complete success of the machining operation, therefore, equal importance must be afforded factors pertinent to the job itself, which process is known henceforth as "Job Planning".

The most important of many factors which affect job planning is the total quantity of parts to be produced as, for examples, either a certain quantity of work parts continuously produced until completion, as in a job contract, or at a required production rate over a limited period of time such as "at the rate of 100 pieces per 8 hours", or a given number of lot quantities over a stated time in a repeat cycle. Other combinations are, of course, possible; in any event, the time element in job planning almost completely influences all other elements.

Scheduling of Prior and Succeeding Operations

Once the time element is established, it is next important to determine the necessity of operations prior to and succeeding the turret lathe operation. This reveals the physical characteristics of the part at the moment of processing on the turret lathe or the condition to which it must be processed for succeeding operations. The part may be wholly processed on the turret lathe; or, it may be blanked out on automatic equipment with secondary operations produced by the turret lathe. Frequently, sub-operations—such as tapping, threading, reaming, lapping, or polishing—may be economical if routed for specialized equipment.

Heavy forgings or castings may be rough machined in the forge shop or foundry prior to delivery to the machine shop for purposes of material savings, stress relief, or machine time savings. The relation of heat treating operations to the turret lathe operation should also be determined. Work parts may be annealed and/or normalized or otherwise treated to improve machinability prior to any machine operation. Stock allowances may be required for grinding after hardening or to protect soft surfaces so that carburized stock may be machined off prior to hardening. Heat treatment to establish physical characteristics may occur prior to the turret lathe operation and thus affect machinability.

The workpiece itself may next be inspected in detail. Bar stock, castings, forgings, stampings, tubing, and extrusions

forms may be machined on a turret lathe. Chemical compositions are important. Cast iron, all steels, common nonferrous alloys, plastics, the valuable metals and rubber are among those materials machined on a turret lathe. A knowledge of the metallurgy of material specifications is valuable as a guide to machinability, cutter life, horsepower required for metal removal, cutting speeds and feeds, cutter design and selection, and fixture design.

Certain materials are known to be abrasive. Oxides may appear in certain aluminum alloy castings and not in forgings. Cast iron, rubber, and some plastics are also abrasive. Recognition of this is a clue to cutter design and type, and selection of feeds and speeds. For machine abrasive materials, it is particularly necessary that cutters have the property of high red hardness. Some steels, notably those with low carbon content, nickel alloys or high chrome alloys have a tendency to "build up" on cutting edges. This may be true also of certain aluminum alloys, copper and zinc. This is again a clue to cutter design, selection of type and speeds and feeds. The hard, polished face of a diamond lapped cemented carbide tool, together with increased top rake angle and maximum speeds help overcome the "built up" edge and simplify control of surface finish.

The shape of the workpiece is important in job planning. Castings or forgings with heavy sections can usually be held rigidly enough to permit maximum feeds and speeds with standard or semi-standard holding devices. However, where excessive metal must be removed from frail workpieces having close tolerances, finishing operations must usually be preceded by separate roughing operations to overcome distortion through stress relief and head dispersion. Conversely, frail work parts with minimum stock allowance may not require roughing cuts for the purpose just outlined, but may require special work holding devices and limited speeds and feeds to minimize distortion.

Axle shafts and such, whose lengths are many times their diameter, if machined from bar stock under conditions of maximum metal removal, may distort from stress relief and end pressure of machine cuts. Reduced speeds and feeds and use of self-supporting "roller" type cutter holders usually overcome the effect of this tendency.

The effect of stock removal from workparts of certain shapes through stress relief and heat dispersion has already been discussed. Stock allowance also determines types of holding devices, number of machining cuts required over any one surface to hold a required tolerance and finish, and the rate of metal removal. Surface finish and size control will be treated later as separate subjects but it can be said here that a direct relation exists between the rate of metal removal and the horsepower required. This, too, will be treated later under "Production Estimating."

The relation of surplus stock to finish part contours should be considered. For example, draft angles and their direction with respect to mold and die split planes, as well as presence of core shift, may determine types of holding devices and order of operations on any given work part.

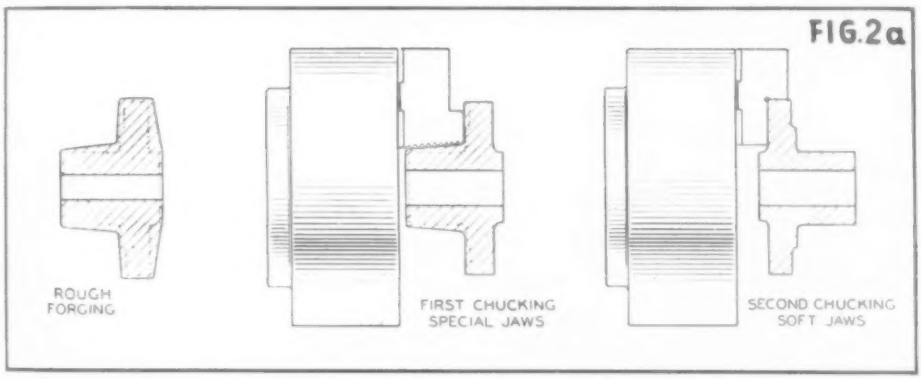
The tolerances and concentricities indicated for a workpiece affect all phases of job planning, including total number of cuts, method of holding, and type of tooling.

The initial considerations in job planning so far reviewed are: Production requirements, necessity for prior and succeeding operations, form and composition of workpiece, stock allowance, and dimensional tolerances. These all pertain to the planned approach to a job and of necessity must be considered simultaneously since they are to some extent interdependent. With these factors in mind, the details of a job plan may be further considered in terms of basic machining theories and types of tooling.

Work Holding Devices

The theory of holding a workpiece for machine cuts is important for it affects the efficiency of the whole producing unit. The function of a holding device, such as a chuck, fixture or arbor, is to grip a workpiece as rigidly, accurately and swiftly as is demanded by the initial considerations of job planning listed above. Whether the device can be standard or must be special is determined from the job characteristics.

For initial operations from the rough, self-centering three-jaw chucks may be used, provided the part is round, nearly so, or has a contour conveniently reached at three equally spaced points. By its universal action, this type chuck is capable of gripping quickly and distributing stock allowances in relation to the gripped-on surfaces. In addition, chucking pressures are distributed within the master jaw bearings equally and in opposition, thus compensating for manufacturing tolerances and wear in the chuck. In effect, this provides a stronger chuck should a choice be possible between a three and two-jaw chuck.



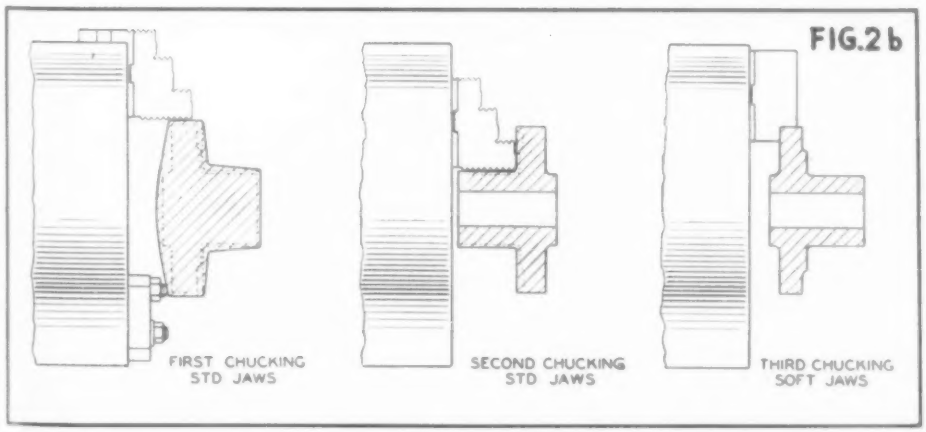


FIG. 2a (at top). Special jaws, designed to fit draft angle of hub, provide solid grip for removing stock from large end of workpiece. Soft jaws, for 2nd operation, grip on finished diameter which, almost twice the diameter to be machined, maintains desirable relationship between driving and cutting torques. FIG. 2b (below). Standard jaws, if used, require an additional chucking since they will not fit the draft angle of the hub. Therefore, a rough cut is first made on the O.D. of the hub to provide a gripping surface for the machining of the large diameter. Soft jaws are then used to grip the large diameter during finish cut of the hub.

Serrated false chuck jaws with compromise radii on the gripping areas may be used on a large variety of jobs for reasons of economy, but special jaws should be used for unusual contours, increased gripping pressure, or to hold frail work parts. When used for increased grip, special jaws should not be so *wide* that a line extended from the corner of one jaw through the axis of the chuck will intersect any part of the opposing jaw, else the workpiece will hang between these points and will not center properly. (See Fig. 1.) Correspondingly, it should not be assumed that a great *length* of grip under a special jaw is required for increased gripping power. Higher specific pressure will develop under a reasonably *short* grip.

When the area of the workpiece containing the greatest stock allowance is to be machined, chuck jaws, where possible, should hold where the greatest grip is possible. It is also advisable that jaws grip upon a diameter nearly equal to or greater than the maximum diameter being machined, so that cutting torque will be equalled or overbalanced by driving torque. (See Fig. 2.)

The four-jaw chuck, though slower in operation than self-centering three or two-jaw chucks, is useful for many purposes. It is most economical for the greatest variety of jobs where chucking time is a minor consideration. Also, it may grip many jobs not easily held in other chucks. Irregularly shaped work and long overhanging work require great gripping pressures and are easily handled in the four-jaw chuck. Difficult problems in stock distribution are also most easily resolved with the four-jaw chuck.

The two-jaw Universal chuck is designed to handle irregular work parts where three equally spaced chucking areas are not available to permit the use of a three-jaw chuck, or where excess opening and closing of the jaws in a three-jaw chuck would be required for loading and unloading the workpiece. The two-jaw chuck will not truly equalize stock allowances in the same sense as will the three-jaw chuck but for some types of work, two-way equalization is acceptable. Valve bodies and miscellaneous hardware goods are typical of the jobs generally suited to a two-jaw chuck.

This chuck may also have jaws which index 360° around their axis at pre-determined increments.

Elbows, tees, crosses, some valve bodies and other work parts may be machined to advantage in a two-jaw indexing chuck where the intersecting axes of the work must be held to close angular tolerances. Unless this latter condition is true, the value of the indexing feature may be somewhat fictitious, since experience shows that separate handling of machined ends are usually faster and less likely to overload tool station space, particularly where the part is small, the machine time cycle short, and variety of cuts large.

For long, overhanging work, pot fixtures may be used in conjunction with three and four-jaw chucks. (See Fig. 3.) A pot fixture is a fabricated or cast housing extended beyond the face of the chuck and in which two or more adjustable screws are placed so they may be brought to bear against the overhanging workpiece to provide additional rigidity under cut. They are particularly valuable where the only available surfaces on the workpiece against which support can be applied are rough and irregular in shape. Should it be possible to support or locate on a round, smooth, or machined diameter in the extended area of the workpiece, a steady rest would be faster acting. (See Fig. 4.)

Holding Devices for Second Operations

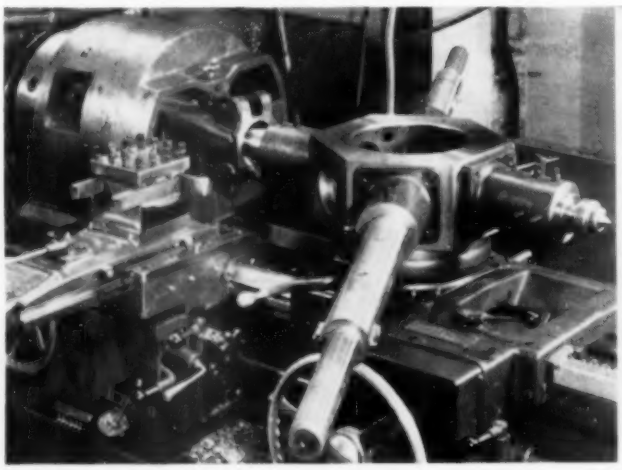
As previously described, these holding devices are commonly used in first operations or holding in the rough. Second operation holding devices, though not usually required to distribute stock, must still grip tightly and frequently grip concentrically with respect to the surfaces to be machined in the holding operation. The four-jaw chuck, used in this respect, though slow, is economical and offers both the means of gripping tightly and means of truing up surfaces on both sides of the workpiece.

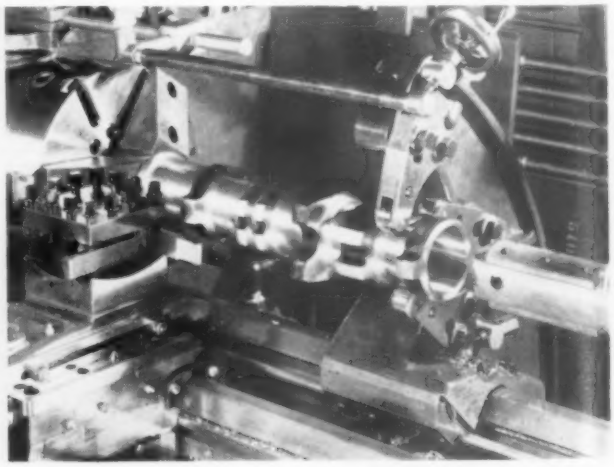
Where no special concentricity is required between sides, the three-jaw chuck with standard top jaws is faster than the four-jaw chuck. Concentricity can be improved with the three-jaw chuck, if soft top jaws are true bored with the chuck under pressure, to suit the diameter being gripped. This will provide concentricity of 0.002" to 0.004" total indicator reading between sides, depending on the condition of the chuck, care that use is made of the same scroll pinion in loading and unloading, and skill in boring the jaws. Soft jaws, so used, may last for a lot of 25 to 50 pieces before reboring. Note that once soft jaws are removed from the chuck, reboring will be necessary to restore their accuracy.

If slightly less concentricity is acceptable between ends, then special top jaws may be hardened and ground in place. Such jaws may grip several hundred work parts before regrinding is necessary. They are not ordinarily reground

FIG. 3. The workpiece shown requires a pot fixture to provide an outboard support while machining. A standard 3-Jaw Universal Chuck grips the piece on one end and screws mounted in the housing or pot are brought to bear against the workpiece. This part is brought to the turret lathe with a wooden plug pressed into the rough bore of the piece and in which appears a center drilled hole. The revolving center support shown in one station of the hexagon turret centralizes the outer end of the piece by locating in the center drilled hole in the plug until the pot fixture screws are brought to position on the workpiece. The plug is then removed to permit actual machining of the piece.

FIG. 4. The above workpiece is readily supported at its outer end by a steady rest, since a pre-machined diameter is available on which to locate the steady rest rolls. The steady rest illustrated has three adjustable arms on which the rolls are mounted. The bottom and back roll arms are adjusted to the required work diameter during the setting up of the job and the top roll indexed in and out of position, for purposes of loading and unloading the workpiece, by means of the hand-wheel. This steady rest is shown mounted on the rear way of a saddle type turret lathe, and it is designed to permit movement of the side hung cross slide carriage to either side of the rolls.





after each removal from the chuck, hence are generally considered less desirable than soft jaws where accuracy is premium over wearing ability.

If second operation accuracy of a greater degree is required for work parts, or if the surfaces machined in the first operation are unsuited to holding in a chuck for the next operation, then clamping fixtures can be used. These are usually designed specially for the individual job, though some flexibility can be had by using interchangeable locating plates and clamping fingers. A clamping fixture usually consists of a spindle face plate on which is fixed a locating ring or arbor to suit the locating area on the workpiece. One or more fingers, or a washer and nut combination, clamp the workpiece against the locating ring or arbor. (See Fig. 5.) Note that clamping should be arranged if possible so that the piece is squeezed through a solid section between the longitudinal stop surface on the fixture and the clamping finger or washer. This eliminates springing or distortion in the workpiece under clamping pressure which might reflect to the surfaces to be machined. The accuracy in terms of total indicator run-out obtainable from a fixture of this type is never closer than twice the difference in size between the work part locating surface and the locating plate or arbor.

If a hole which has been machined in a first operation on the centerline of a work part must run true or square with the second operation surfaces, then solid taper arbors or expanding straight arbors may be used. If the hole is under an inch in diameter, then a solid arbor is preferred for design reasons. If the hole is over an inch in diameter, then expanding arbors are practicable. Either type arbor can equalize, one through expansion and the other by the taper, the difference in size between locator and workpiece thus providing very accurate registration.

Occasionally a workpiece is encountered where all diameters must run dead true to the bore and all faces must be square with each other and the bore. This is *not* a turret lathe job. The bore may be finished on the turret lathe and finishing stock allowed on the remaining surfaces. The piece should then be mounted through the bore on a taper arbor and held between centers either on an engine lathe or production lathe, and all critical surfaces finished in one setting or chucking.

Bar Stock Holding Devices

Methods of holding so far expressed are applicable to individual work parts as might be cast, forged or fabricated. However, an equal volume of work is machined on turret lathes from bar stock in its various forms. Standard holding devices developed for this class of work are known as collets, and several types are available to satisfy different job requirements.

For use in gripping bar stock approximately three inches or under in diameter, where compositions in cold finished sizes are ordinarily available and where hot finished sizes within this range do not vary appreciably, the simplest and most accurate collet is the spring or heel type collet. (See Figs. 6a and b.) This is a single piece collet with a taper nose which is closed by being pressed against a mating taper in a hood affixed to the spindle nose. This type collet is usually partially split from the nose to the heel to assist in springing the collet to a closed position for holding. Splits may number three or more but rarely two, since a two-split collet is stiff and would require considerable force to close it.

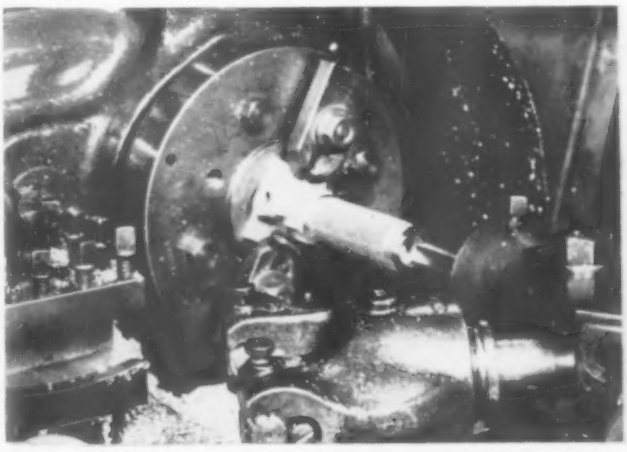
Although the spring collet is unable to accommodate work whose diameters vary more than a few thousandths of an inch, thereby eliminating most castings, forgings, and larger sizes of hot finished stock, it is by inherent design and method of manufacture most able to hold work parts concentric to the spindle centerline. Since it is of one piece construction, the collet nose taper, holding bore, heel diameter, and heel face can be ground in accurate relation to one another. The accuracy of holding may thus be repeated, and the absence of fitted sleeves—necessary to the operation of some other types of collets—helps maintain its accuracy. Spring collets may be pushout, drawback, or extra capacity in either form for short workpiece lengths. (See Fig. 7.)

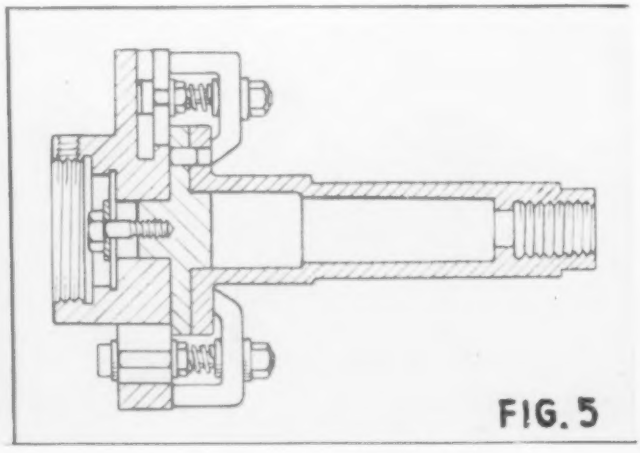
Since most turret lathe spring collets have 28° angle nose tapers, the longitudinal or stopping position of work parts held by the collet may be expected to vary from piece to piece in ratio of two units longitudinally to each unit change radially on the workpiece holding diameter.

A different type collet, called the stationary closing type, is useful where it is desired to grip work parts so that no longitudinal variation occurs in the closed position. (See Fig. 8.) It, too, is a one-piece spring-type collet but depends for its closing action upon a moving sleeve which mates with the taper collet nose. As the sleeve moves against the collet nose, it closes the nose inward during which any longitudinal variation in position of the collet is arrested by its impingement against a flat surface at right angles to the direction of collet travel. This flat surface is integral with the collet hood which in turn is integral with the spindle nose. This type collet offers less radial accuracy than the plain spring collet since it incorporates sliding components, due to wear which exaggerates manufacturing and assembly tolerances in the fit between these sleeves.

A variation of the stationary closing type collet is used on larger turret lathes to accommodate hot finished bar stock in the larger sizes where diametral variation may be expected. (See Fig. 9.) With this type collet, eccentricity between operations of 0.006 to 0.015" T.I.R. may be expected. Therefore, it is rarely used for second operation

FIG. 5. At left, photograph of a faceplate clamping fixture. At right, a schematic drawing showing the location plug on which the workpiece is positioned radially. The clamping fingers press the workpiece against the stop surface through solid metal.





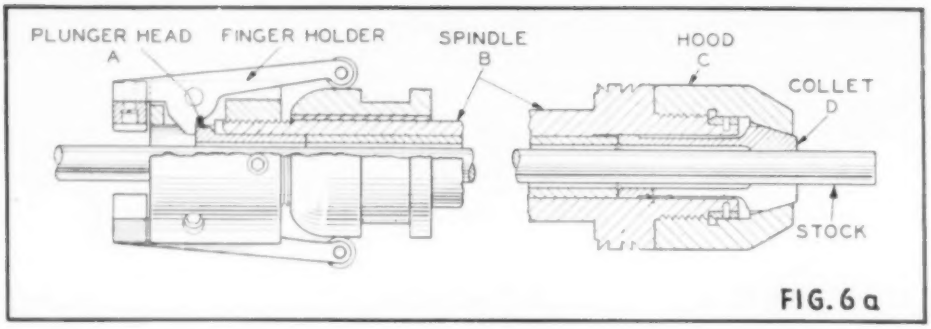


FIG. 6a

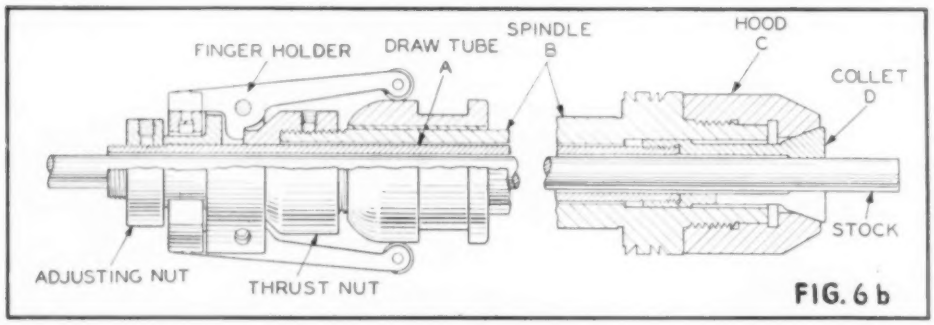


FIG. 6b

FIG. 6a (at top) shows a pushout type collet chuck for turret lathes. A drawback collet is shown in FIG. 6b (below). In either case the collet is closed by being pressed against a taper in the spindle hood. The simplicity of this collet design, and absence of fitted parts, permit maximum radial accuracy in the gripping of bar stock for first or second operations.

work where surfaces must be machined concentric with those produced in the first operation.

Maintaining Close Tolerances

Once the holding method is decided for a turret lathe job, it becomes possible to determine how the surplus stock may best be removed to establish the desired dimensional tolerances and surface finishes.

Depending to a large extent on the type material, tolerances of 0.001" and micro-inch finishes of 60 or less can be produced on the turret lathe. The ease of holding a close tolerance on any machine tool is inversely proportional to the size of the diameter on which it must be held. Tooling rigidity is a necessary attribute for holding size and finish to required limits. Cutter cross sections should be ample, and cutter holders should be designed to provide adequate support under the cutter. It is well to pilot roughing tools wherever possible not only to permit increased feeds but to minimize cutter holder deflection. This allows a uniform amount of stock to remain on the workpiece for finishing cuts, which is a basic requirement for holding work to close tolerances.

It is frequently inadvisable to center pilot finish boring or reaming cuts when they are taken at high spindle speeds on a geared head turret lathe. Heat is generated in the lathe headstock when run for long periods at high speeds, and this heat may prevent the spindle from maintaining a constant position in relation to the axes of the cutting tools. This reflects on the work in terms of undersize holes, oversize holes, or taper holes. Spindle variation due to temperature rise affects turning cuts as well. A simple means of circumventing this condition is to determine whether the savings in cutting time accruing from operating at these extreme spindle speeds are great enough, when compared to the cutting time resulting from the use of slightly lower speeds, to offset the attendant loss in accuracy and efficiency. This is an important calculation to make and one which is often overlooked.

For normal conditions, however, center piloting or overhead piloting of finishing tools is usually helpful to overcome any misalignment between the hexagon turret and spindle axes due to wear or index error. The best way to produce a true, round hole with a minimum of taper is by the single point boring cutter held in a stub bar, provided all machine elements are in good repair. The deflection in such a bar is constant while with the piloted bar the distance between the pilot bushing support and cutter diminishes as the cut progresses.

For turning most materials where tolerances in excess of 0.005" are allowed, two cuts, one roughing and one finishing, will produce satisfactory control for size and finish. If tolerances of less than 0.005" are to be held, three cuts may be required, i.e., one roughing, one semi-finishing, and one for sizing. This is especially true under any of these conditions: If (1) the diameter is large, (2) the stock allowance is great, (3) the material is abrasive, (4) gaging time is to be minimized.

Principles of Machining Holes

There are many types of holes in workpieces produced on the turret lathe, a full description of which is not possible here. There are, however, basic approaches applying to the machining of all holes which bear review.

If a hole must be machined from the solid, then it should be start drilled to provide a true cone for the drill which

FIG. 7 (at left, above) shows a drawback collet chuck with extra capacity for holding work larger than permitted by the standard collet chuck shown in Figs. 6a and 6b. While the length of work gripped is relatively limited, the drawback action forces the workpiece against stop pins (a desirable feature) thus insuring close shoulder tolerances and the maintaining of overall dimensions. This type collet is also available in the pushout design. FIG. 8 (at right) shows a stationary closing type collet which, during its closing action, impinges against the shoulder stop on the hood. The hood is integral with the fixed spindle nose thus the longitudinal position of the collet in its closed position does not vary from piece to piece.

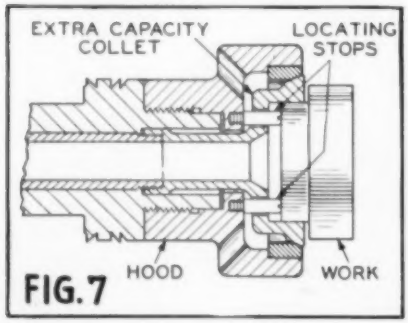


FIG. 7

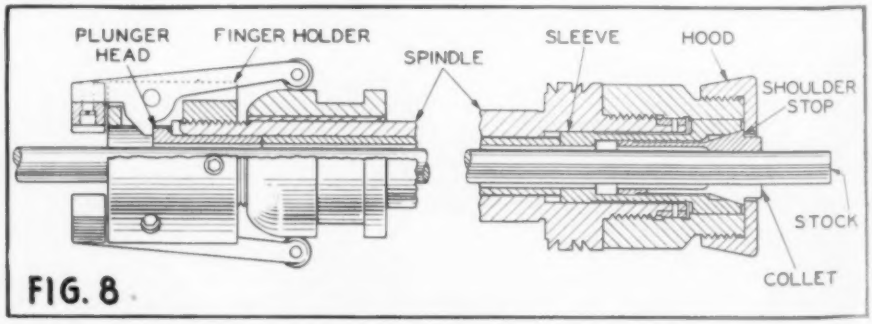


FIG. 8

FIG. [illegible] (at right) shows how grinding the lip [illegible] of a starting drill to 52° provides a shallow cone (B) for entry of the [illegible] drill which is ground to 59°. The [illegible] drill thus assumes a position concentric with the work axis as it meets the [illegible] cone at "A."

FIG. [illegible] (at left) shows a variation of the stationary closing type collet. Known as a [illegible] closing collet, to distinguish it from the types shown in Figs. 6a, 6b, and 7, it is used on large turret lathes when not finished bar stock in the larger sizes must be gripped. The adjusting nut, on the face of the collet, provides a variation in gripping position of 1/16" from the normal bar diameter. Opening and closing the collet from outside, by means of a yoke, eliminates the need of a push tube, thereby utilizing the maximum capacity of the spindle bore for passage of bar stock.

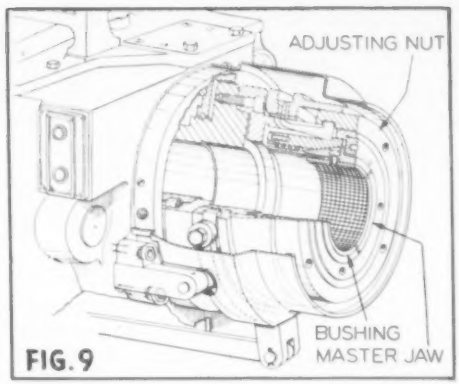


FIG. 9

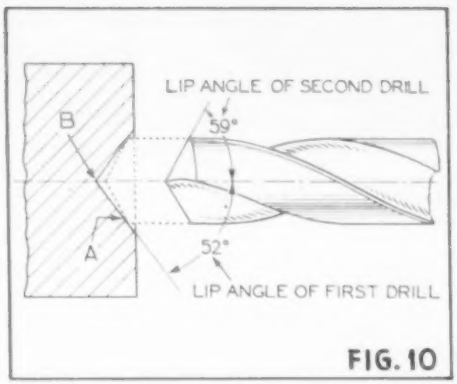


FIG. 10

follows. (See Fig. 10.) Providing the stock is fairly homogeneous, without hard spots, the drill is machine ground and kept sharp, and the feeds and speeds are moderate, a start drilling operation, followed by the full length drill, will produce a hole which is reasonably straight and round for depths of about five times its diameter. If such a hole must be held to a tolerance of 0.002" or less on the diameter and assurance is desired that it will be straight and perfectly round under production conditions, then true boring with a single point tool will relieve the drill of much responsibility in this respect. If a tolerance of less than 0.002 inch is required, then the hole should be reamed after boring. A cored hole similar in proportion to the above should be start chamfered and then enlarged to size with a core drill or rose reamer.

Sometimes it is necessary to produce a hole from the solid with strict limits of size, straightness, and finish where the depth is greater than five times the diameter. If the diameter of this hole is large enough, it may be true bored and reamed in the conventional manner. If not, other measures must be followed, for instance, the drill speeder. (See Figs 11 and 12). In this case, the drill is rotated, by an independent power source mounted on the hexagon turret, in a direction opposite to that of the workpiece. This will produce a straighter hole than that obtained when the drill does not rotate. Reaming for size and finish may follow if desired.

Should a drill speeder be unavailable and provided sufficient stations are available on the hexagon turret, the hole can be start drilled, then drilled undersize to depth in the conventional manner. This undersize hole, which in itself may not meet specifications, is then true bored to finish size with a single point tool for a depth of about 1½ diameters. Next, a core drill, of the same size as that of the finished hole, is inserted into the true bored pilot hole and allowed to bore the hole for the remaining depth. This core could be ground square on the cutting end to eliminate any cutting force reactions except those parallel to the direction of feed. It is the force reactions normal to a drill point or chamfer which encourage any tendency of the drill to weave.

Special vs. Standard Tooling

The job planner must continually determine whether special tooling will pay for itself within the job limitations Some jobs cannot be machined without a few special tools but the average job offers a range in choice of setups comprising all combinations of standard and special tools. Which choice is made must be left up to the individual company, since amortization policies and job requirements vary widely. Generally speaking, however, special tooling should not be used where the aggregate time savings computed against the job overhead does not permit the amortization of any particular tool within the life expectancy of that tool.

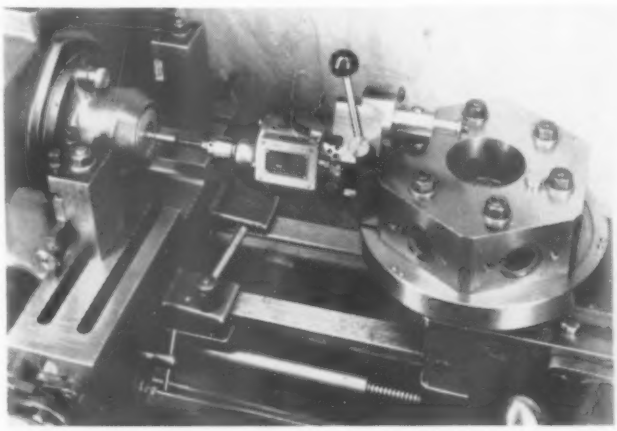
Standard tools such as chucks, multiple turning heads, tool holders of many kinds, boring bars, cross slide cutter blocks, and bar turners are available for turret lathes and should be considered for the average tooling job. These standard tools are produced by the manufacturer in production, priced moderately, and have a historical background of design stemming from the repeated previous necessity of duplicating them as special tools. They are thus universal and flexible and more than likely to answer many special tooling needs acceptably.

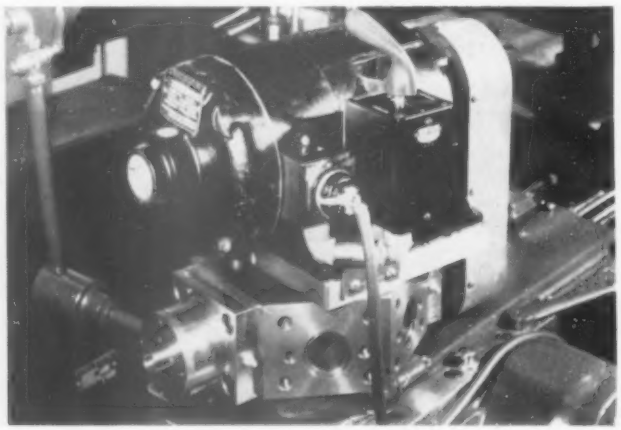
Production Estimating

Production Estimating is the creative phase in Job Planning. With the background of job analysis—reviewed in the foregoing—as a basis, the job planner must next set down in schematic form the recommended arrangement of tooling

FIG. 11. A drill speeder for use on ram type turret lathes. By means of an independent power source, the drill can be rotated in a direction opposite to the rotation of the machine spindle, this not only insuring a straight hole but more nearly approximating the cutting speed of small drills. The knob handle on the drill bracket provides an auxiliary sensitive feed, especially desirable for small diameter drills.

FIG. 12 shows another type of drill speeder, to be used on ram type turret lathes for larger drills. The design shown incorporates a ¾ HP geared head motor connected by a chain drive to the drill quill, which is held between opposing faces of the hexagon turret. The drill quill, in turn, incorporates anti-friction bearings, and the unit may be easily and quickly attached to, or dismounted from, the turret.





and usually calculate the estimated production.

The total time for producing any machined part—exclusive of setting up time—consists of cutting time, machine handling time, and work handling time. The manner in which machine and work handling time affect the time study is now obvious from previous discussions, and in this respect all that remains for the job planner is to set quantitative values for them in the time study. To supplement the individual shop's experience, turret lathe manufacturers are able to provide average time standards for indexing and maneuvering the various machine elements, including holding devices.

The question of machinability arises which in a sense is the least definite of all principles of job planning. Stated one way, all materials are machinable provided they may be attacked by the cutting medium. The rate of machining, then, should be a practical expression of the economic relation between work material and cutter life. Rates of machining vary with the workpiece material and with the cutting material as well as with types of tools. For instance, S.A.E.-1020 steel should be machined at different angles with high speed steel cutters than with cemented carbide cutters, assuming equal cutter life is desired. Brass as a work material would demand a new set of rates for each cutter medium. Furthermore, for any one combination of work material and cutter medium, different rates would apply for cuts with single point tools, form cutters, reamers or taps. In any event, a practical machining rate for the tool should be selected with a desired cutter life in mind.

Cutting tool manufacturers, technical societies, and private investigators have made available to the job planner numerous tables of machining rates, feeds and machinability indices or different materials. Such tables are deliberately omitted from this article to permit re-examination of the factors incident to the practical use of this published data.

Use of Tables of Machining Rates

For instance, one table of machining rates suggests 250 S.F.P.M., presumably for a starting point, when rough machining cast iron with cemented carbides and 400 S.F.P.M. for finishing. These rates are simply milestones between the lower and upper limits of machinability of this work material with the given cutting material. Cutter life immediately enters the consideration. If the job is simple and involves the resetting of few cutters which are expected to machine the workpiece to wide limits of tolerance and finish, then it might be wiser to accept a relatively shorter cutter life by raising the cutting rate and thus reducing the cutting time. Conversely, if a job is complicated, involves the resetting of many cutters, and requires the maintenance of sharp cutting edges to protect surface finish and to hold fine limits of tolerance, then a longer cutting life is desirable and this means a reduction of cutting rates. The number of pieces in a lot or to be machined during a setup has a large effect, of course, on whether rates must be related to life of the cutting edge between grinds.

Power available at the cutter will also determine permissible cutting rates. The size drive motor and machine headstock efficiencies allow just so much work to be expended upon the workpiece in the form of metal removal. Headstock efficiencies of a turret lathe may vary from 50 to 85 percent, depending upon the condition of the gears, shafts, bearings, method of lubrication, design, and speed. A 10 HP drive motor may thus deliver from 5 to 8.5 HP at the cut under conditions of normal load. As an example, bearing bronze bushings may easily be machined with carbide tools

TABLE I. The tabulated data provides a quick check on power requirements for various combinations of materials, depths of cut, and speeds and feeds. Common sizes of turret lathe drive motors are listed in the extreme left-hand column. The next column corrects the power for headstocks having an efficiency of 85%. For example, a 0.375" depth of cut in bronze, if taken at 600 SFPM and at 0.032" per revolution feed, would require 21.25 HP at the spindle. If the efficiency of this lathe headstock, considering all factors, is 85%, a drive motor rated at 25 HP would be required.

H.P. CHECK LIST FOR MAT'L. vs. SPEED vs. FEED vs. DEPTH

HP at Motor	HP at Spindle	Bronze (80-10-10)	Cast Iron	Screw Stock	SAE-1040 Bh-180	SAE-1020 Bh-137 -4140 Bh 207 -4340 Bh-207-302	52100 Bh-187 SAE-1095 Bh-190	SAE-4140 Bh-429
Mean Surface F.P.M.		600	250	350	300	250	200	200
Depth 5	4.25	.187	.187	.187	.187	.187	.187	.027
Feed		.013	.019	.010	.011	.011	.012	.012
Depth 7½	6.37	.187	.187	.187	.187	.187	.187	.187
Feed		.019	.029	.014	.016	.017	.019	.017
Depth 10	8.5	.250	.250	.250	.250	.250	.250	.250
Feed		.019	.028	.015	.016	.017	.019	.017
Depth 15	12.75	.250	.250	.250	.250	.250	.250	.250
Feed		.028	.042	.020	.023	.025	.027	.025
Depth 20	17.00	.375	.375	.375	.375	.375	.375	.375
Feed		.025	.037	.019	.020	.022	.024	.022
Depth 25	21.25	.375	.375	.375	.375	.375	.375	.375
Feed		.032	.047	.023	.026	.027	.030	.028
Depth 30	25.50	.500	.500	.500	.500	.500	.500	.500
Feed		.028	.041	.021	.022	.024	.027	.025
Depth 40	34.00	.500	.500	.500	.500	.500	.500	.500
Feed		.037	.054	.027	.030	.033	.035	.033
Depth 50	42.5	.750	.750	.750	.750	.750	.750	.750
Feed		.031	.044	.023	.025	.027	.029	.027

rates exceeding the power capacity of certain sizes of ret lathes on which parts of that physical size might nor- lly be placed. This means that given a certain size turret e on which the job planner must schedule a job, power ilable is a factor in determining cutting speed.

Other factors contribute to the setting of cutting speeds. ong these are shape and form of the cutter. Tools for ning, drilling, counterboring, forming and cutting off may be made of high speed steel and yet for the same work terial require different cutting rates. The shape of a rning tool by itself may vary the permissible rate. Some ch shapes require more power for metal removal, thus directly affecting the cutting rate. Or, if a tool must turn to a shoulder and blend with a sharp corner, then the cut- ng tool being ground with this small radius may not be able to withstand maximum cutting rates. Cutters with small cross sectional area cannot carry heat from a cutting edge as rapidly as cutters with large cross sections, and this lack of heat transfer may impair the ability of the cutting edge to withstand maximum cutting rates.

Another factor indirectly affecting cutting rate is the shape of the workpiece. An asymmetrical workpiece may not be rotated beyond certain speeds if vibration is to be controlled, thus limiting cutting rates according to the size of the diam- eters to be machined. A workpiece may also have interrupted surfaces to be machined which call for reduced cutting rates.

Rigidity of the machine elements and cutter holders also affect cutting speeds. It is not intended to confuse the issue of machinability by reviewing some of the factors affecting the choice of a cutting rate. It is definitely the author's in- tention to warn the job planner of these factors so that full allowance may be made for them when he must set a theoretical production rate or correct an estimated rate after the planned job is put in operation.

In the actual process of removing metal, three factors are important. Depth of cut is usually set by characteristics of the workpiece. Speed, in terms of surface feet per minute, is a matter of relating various workpiece diameters to the practical machining rates for different types and forms of cutters. Feed, in terms of cutter travel per spindle revolu- tion, is a variable depending on strength of the workpiece, the holding device, the finish desired, and the power avail- able. If greater metal removal is desirable, for any given cutter life and with due regard for power limitations, the three foregoing variables should be increased in the following order, (1) depth of cut, (2) feed, and (3) speed.

Relations of Available Power

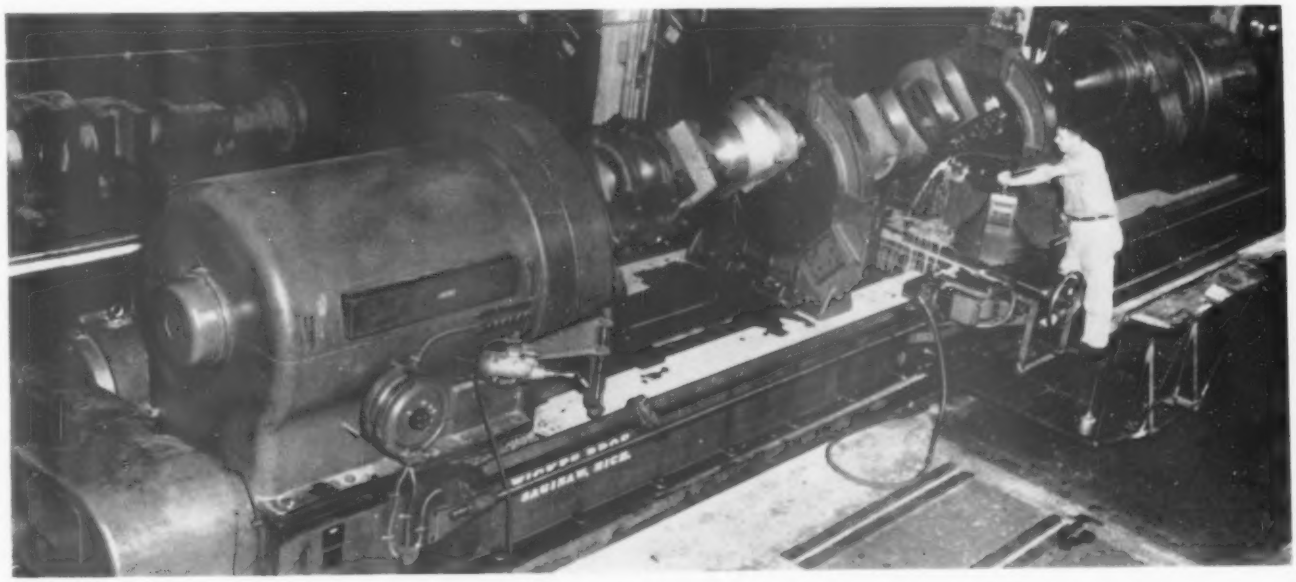
If all other factors of a job permit conditions of maximum metal removal, available power is of prime importance. Turret lathe manufacturers can furnish tables showing head- stock efficiencies and the horsepower available at the cutter for different spindle speeds and various sizes of drive motors. Knowing this, the job planner can use any of the power calculators available from motor and cutter manufacturers to figure which combination of depth, speed, and feed, most closely relates to the power available at the cutter. As a quick check list, Table I illustrates, for different common materials, certain combinations of speeds, feeds, and depths of cut which result in specified horsepower requirements. For all practical purposes, these factors bear a straight line relationship to one another. That is, if horsepower is kept constant, the feed may be doubled if the depth of cut or speed is halved. Or the speed may be doubled, holding constant all other factors except horsepower, which must then be doubled.

END OF PART 1, this article. The concluding install- ment will appear in March, The Tool Engineer.

Huge Lathe Speeds Turning of Diesel Crankshafts

DESIGN THE PRODUCT, and tool engineers will design the tool for its manufacture. This truism is further sub- stantiated in the case of a mammoth lathe, built by Wickes Brothers, of Saginaw, Michigan, for machining crankshafts for large Diesel engines. Two of these lathes, each 45 feet long, have recently been installed at the Superior Engine Division of the National Supply Company, Springfield, Ohio, as part of the plant program of expansion and moderniza- tion.

The machine is power driven at both head and tail stocks, with variable speed control of the DC motor drive and hydraulic feeds to carriage and cross slide. The crankshaft forgings, which weigh approximately 8-½ tons in the rough, are mounted in pot fixtures adapted to the face plates (each 60″ in diameter) of both head and tail stocks, insuring rigid support and, since both ends are driven, synchronized and positive drive. Speed range, from one to 25 RPM, permits a cutting speed of 50 SFM.



by Gunnar Skog

New Pantograph Simplifies Duplicating

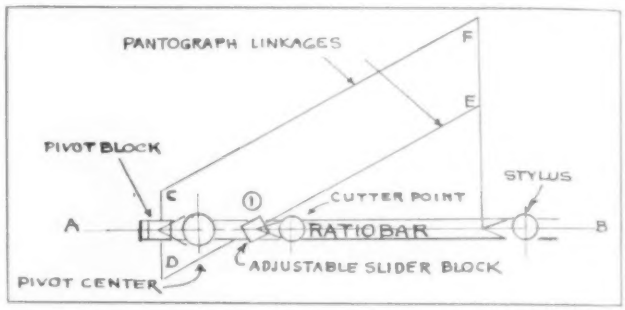
A NEW 3-dimensional Pantograph Machine—the P13, by George Gorton Machine Company, Racine, Wisconsin—is said to feature the first basic improvement in pantograph engraving machines since 1825, when the first machine of this type was built. While directly comparable to the popular Gorton 3-U two-dimensional Pantograph in size, work holding capacity and ability to remove metal, and incorporating the same reduction ratios with the exception of 1 : 1, a fundamental improvement in design greatly simplifies its operation.

This improvement is the Ratiobar, an exclusive Gorton development which, supported at either end by a rugged yet delicately balanced over-arm, aligns the pivot center, cutter spindle and tracing stylus in an absolutely straight line. As shown in the line drawing, this Ratiobar simplifies accurate setting by maintaining this straight line from A to B at all pantograph settings. Another feature is that, with the Ratiobar, there is only one slider block to adjust for whatever reduction ratio is desired. This greatly reduces the chance for error.

This 3-dimensional machine employs an enlarged 3-dimensional master, or pattern, which is mounted on the copy table. The surface of the master is traced in three dimensions, manually, with the tracing style, while the cutter reproduces, at the desired ratio of reduction on the workpiece, all of the angles, curves and surfaces of the master. The machine is designed to accurately reproduce small, intricate dies, molds, stamps and hobs in addition to performing the conventional type of work usually associated with light pantograph machines.

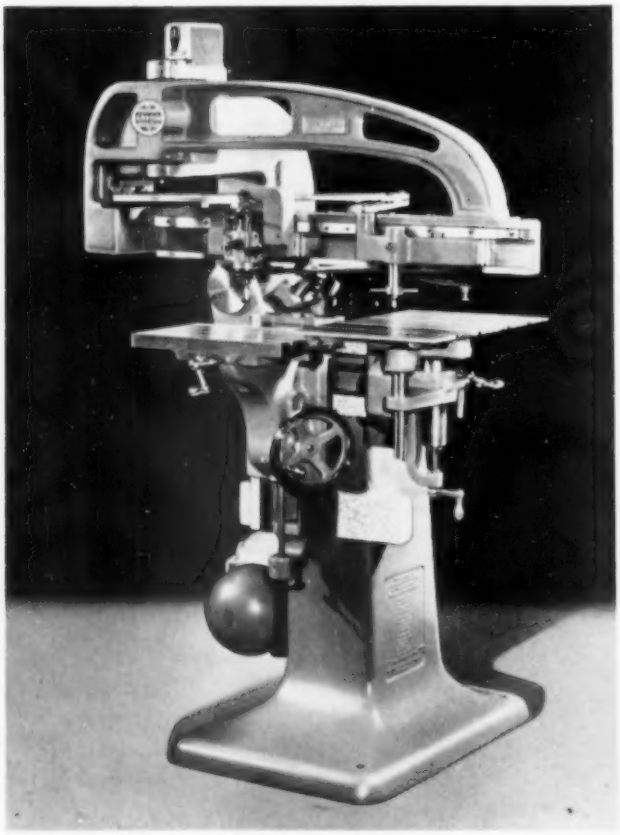
Also, by George Gorton Company, is a new Universal Head Milling Machine—the O-16A—which supersedes the former 8-D fixed head Vertical Miller. The new machine, which is ram type, is designed for unusual sensitivity and convenience of operation. The operator can sit in a normal and comfortable position. While essentially designed for tool, die and production work on small parts, the machine can be supplied especially equipped for general engraving, brass routing and duplicating.

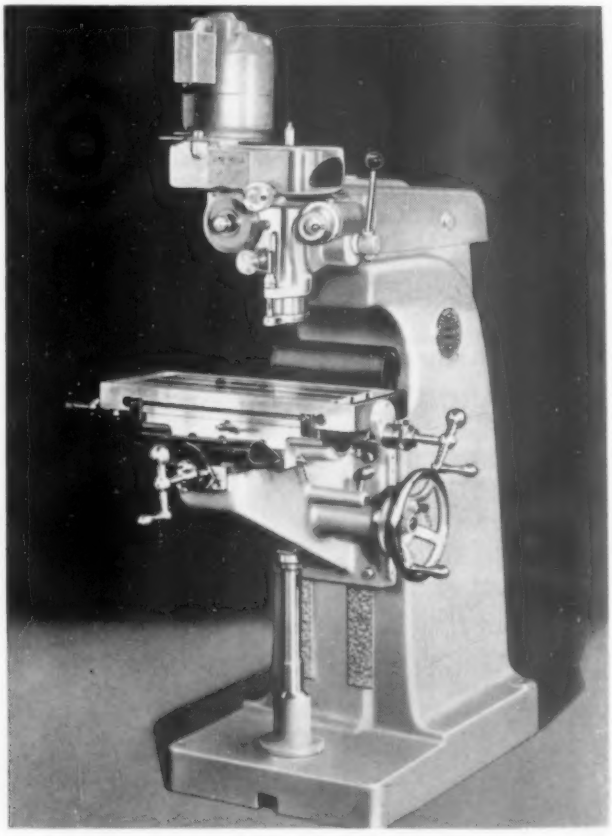
Features include positive spindle braking for instantaneous stopping and locking of the spindle, a screw-type spindle depth stop graduated in thousandths. A safety feature is provided at the swivel and universal joints to overcome slipping or dropping the head, with consequent damage to machine or work. The head is easily set to any angle.



Schematic diagram of the Gorton Ratiobar design. Dotted line A-B is absolute straignt at all times and area C-D-E-F is maintained a true parallelogram.

At left, the new Gorton P13 3-dimensional Pantograph Machine. At right, the new Gorton O-16A Universal Head Milling Machine.





by John R. Parks

57—10000

The Bellows Type Thermostat

In which the author presents several theoretical considerations on procedures for manufacture

THE BELLOWS TYPE THERMOSTAT is in very general use where temperature requires control, for some purpose. Its most common use, however, is in connection with motor temperature control in automobiles, where it acts as a control valve allowing more water to pass to the radiator as the motor temperature rises above the starting temperature of the stat itself.

Thermostats of various starting temperatures are available. In winter time, stats with higher starting temperatures are popular inasmuch as they aid in quicker motor warm-up and a greater supply of hot water to the car heater. Also available are adjustable stats that can be set to the desired summer or winter running temperatures.

Fig. 1 shows an automobile thermostat of typical bellows construction. The bellows is a corrugated, thin wall tube containing several cc (cubic centimeters) of some sealed-in volatile liquid. As the temperature rises, the vapor pressure of the "fill" expands the bellows, thus opening the valve and allowing more water to pass to the radiator. The bellows is made from a drawn and annealed brass tube, of approximately .004″ wall thickness, and corrugated by means of hydrostatic pressure in a collapsible die. Collapsing the tube work hardens the metal so that the finished bellows behaves like a spring and obeys Hooke's law.

The manufacturing procedure is roughly illustrated by the cross-section of a thermostat shown in Fig. 2. The strap, bellows and stem are soldered together on a high production conveyor-type furnace. Next, the strap is bradded onto the flange. Next, at a vacuum bench, the "fill" is introduced into the bellows and the vacuum drawn and sealed in. The fill is generally of some organic liquids like alcohols, esters or ethers, or mixtures of these. The prime requisites of the fill are that it shall have the proper vapor-pressure temperature curve and that it shall not tend to corrode the bellows.

After the soldering operation, approximately 5 cc of fill is introduced into the bellows assembly through the hollow stem. Next, it is screwed to a combination vacuum machine and arbor-press. A vacuum of approximately 29 inches of mercury (29″ Hg) is drawn on the bellows, thus boiling the fill and sweeping the bellows clean of air. An oversize brass pin is then pressed into the stem, sealing the assembly. By installing a suitable condenser on the exhaust of the vacuum pump, a large part of the fill that boils out of the bellows can be salvaged.

The valves are next assembled, after which they are turned over to Inspection for regulating. An inspector-operator places fifteen or twenty stats on a rack and lowers them into a tank of water, heated with steam coils, the temperature of which is controlled by an adjustable, thermostatically controlled steam valve. The operator then adjusts the water temperature to the specified starting temperature for the stat and stirs the water, the level of which just comes to the tops of the stats.

FIG. 1. TYPICAL THERMOSTAT

After making sure that a stable temperature has been reached, the operator screws the valves down on the stems until they just clear the valve seat. He verifies the valve setting by tapping them lightly with his finger tips and listening to the kind of clicking sound they make against the valve seat. An experienced operator can readily pick out and segregate the "slow" and "fast" stats. Slow stats, so-called because they start opening at temperatures higher than that specified, are those the stems of which rise only high enough to engage one or two threads on the valve. The fast stats are at the other extreme, the stems protrude through the valve by one or more threads at the specified starting temperature.

The water temperature is next adjusted to the specified full open temperature and the good stats spot checked with a gage for the proper gap between the valve and valve seat. After this, they are sent to the soldering bench, where the valve is soldered to the stem. The stats are then ready for shipping.

A Schematic Presentation

Now that we have hurriedly covered the main steps of manufacture, let us turn to Fig. 3, a schematic representation of the bellows assembly with a "fill" and the vacuum drawn and sealed. The piston and cylinder represent the bellows as a container, while the spring duplicates the spring tension of the bellows. As shown, there are three forces that operate the thermostat, viz:

The vapor pressure due to the fill—V″ Hg (V-inches of Mercury);
the spring pressure of the bellow—S″ Hg; and
the atmospheric pressure A″ Hg.

Pressures V and S act opposite to A and from this a simple equation can be written at any temperature between the start and full open positions of the stat. This equation is:

$$V/S=A \qquad (1)$$

Now, A is a constant, hence, for any change in V there must be an equal and opposite change in S. The vapor pressure of any given fill is a function of temperature alone. Since the tension in a spring—i. e., within the limits of temperature we are discussing—is independent of temperature we can conclude that equation (1) is a function of temperature alone. This means that if the temperature is some value, T, such that

(T_s=starting temp.
$T_s < T < T_f$
(T_f=full open temp.

then V and S must be values that satisfy equation (1); that is, the spring will be a certain length and the piston will be at the corresponding height and the vapor pressure a certain value.

If the temperature increases a few degrees, the vapor pressure of the fill also increases. From equation (1), the spring pressure must decrease by the same amount or—what is the same thing—the length of the spring increases

until the spring pressure is such that when, added to the vapor pressure, the result is atmospheric pressure. At this point the piston will cease to rise.

From this discussion, we see what we already knew but a good deal more clearly and that is how the height of the valve above the valve seat is a function of temperature alone. Up to this point the thermostat has been discussed more or less qualitatively. A quick glance at the vapor pressure properties of fills should put us in a position to consider our problem more quantitatively.

Vapor pressure vs temperature data on pure materials, suitable for fills, can be found in most good handbooks on chemistry. If the data on ethyl alcohol are plotted on a graph with the vertical axis as pressure in inches of Mercury, and the horizontal axis as temperature in degrees Fahrenheit, a curve similar to curve AB in Fig. 4 will be generated. It is an exponential type of curve and rises rapidly with increasing temperature.

All the materials of this type have similar vapor pressure, temperature curves, but they lie in different portions of the temperature and vapor pressure scales. This can be seen by checking the vapor pressures of various possible fills at, say, 140°F. At this temperature, ethyl alcohol has a vapor pressure of 13.8″ Hg, carbon bisulfide 46.2″ Hg, and benzol 15.4″ Hg.

Requirements Determine Dimensions

In general, a pure fill cannot be found that will operate a given thermostat between the specified starting and full open temperatures. Mixtures must be resorted to. Published data on such mixtures are scarce or do not exist, so that general practice is "cut and try". There is, however, simple laboratory equipment by which vapor pressor vs temperature data can be ascertained.

From what has been discussed thus far, it can be seen that, from the viewpoint of operation, a thermostat can be defined by fixing the spring pressure of the bellows in the closed position (by closed position it is meant collapsed but not beyond the elastic limit in compression) and the starting temperature. Generally, thermostats are designed so that, at the full open position, the bellows is at its free length with the spring pressure equal to zero, at which point the vapor pressure of the fill is equal to the atmospheric pressure. See point 'B' in Fig. 4. When the starting temperature and the spring pressure of the bellows in the closed position are fixed, the problem is to pick the correct fill.

An example of this procedure is as follows: The physical dimensions of a thermostat are principally determined by the job it is intended to do and the position in or relative to the motor block in which it is to be placed. On the basis of these limitations, design engineers specify the inside and outside diameters and the number of free convolutions of the bellows. A sample thermostat with this bellows is found to have a spring pressure in the closed position of 10″ Hg. Atmospheric pressure is normally taken to be 30″ Hg. Let us therefore assume that the specified starting temperature is 165°F. Substituting the pressure values in equation (1), we conclude that our fill must be one that has a vapor pressure of 20″ Hg at 165°F.

Consulting the tables in a handbook, it is seen that ethyl alcohol comes closest to our requirements. At 154°F it has a vapor pressure of 20″ HG and would start the stat 11 degrees too soon. Ethyl alcohol would therefore be a "fast fill" for this thermostat. The tables also show that water is a very "slow fill" having a vapor pressure of 20″ Hg at 192°F, or 27 degrees too late. However, a mixture of these two could be found that would have a vapor pressure of 20″ Hg at 165°F.

Usually, the method of finding the proper mixture is cut-and-try. By far the best, however, is to make laboratory runs, of vapor pressure vs temperature measurements, for permanent record on a series of mixtures and with the proper equipment. Such data can be of great help in this type of problem.

It can be noted, here, that a thermostat with ethyl alcohol as the fill would start at 154°F and be full open at 172°F, the vapor pressure of ethyl alcohol at 172°F being 30″ Hg. In this case, the temperature differential is 18 degrees. It can be mentioned, in this connection, that the buyer usually specifies the starting temperature and temperature differential of the stat. Later, in this article, ways will be pointed out on how both fast and slow fills can be made to open a stat at the specified starting temperature.

So far, the influence of fill and spring pressure of the bellows has been discussed. The example given was based on a sample thermostat made up especially for the design engineers. Of course, the 864 question is: How close can the factory come to this sample? Random selection of three samples of a bellows from a production run showed the following spring properties:

Sample No.	Free Lgth. In.	Spring Press Col. In. Hg.	Spring Rate In. Hg./In.
1	1.125	7.3	28.4
2	1.251	11.5	29.0
3	1.155	8.9	27.5

This data shows that, in the process of making bellows up to the point of soldering to the strap and stem, they vary considerably in free length, thus causing a corresponding variation in the spring pressure in the collapsed position. The total variation of 4.2″ Hg shown here would cause an approximate 10 degree variation in the starting temperature with an ethyl alcohol fill. This is too much. An attempt was made to correct or ameliorate this condition by placing an added operation just ahead of soldering the bellows to the strap and stem.

A large number of bellows were struck at one time between flat dies on a punch press. This had a tendency to reduce the variation in free length and, all things being equal, should have improved the finished thermostat. Apparently it did not. The operation was dropped and, as far as could be discovered, no data had been kept by the factory. While the operation was a step in the right direction, the results were masked by subsequent operations, as will be indicated later. Improvement of the situation could have been made by a different method of handling, trucking and cleaning. With all the variation in free length the spring rate of the bellows showed relatively small change.

Various Types Described

Fig. 4 illustrates the action of a thermostat, completely as designed and as tested in the inspection tanks. It also describes the various types of thermostats that will be found in a production run. The vertical line indicates the pressure inside the thermostat in inches of mercury, while the horizontal line is in degrees Fahrenheit. Curve AA″B is the vapor pressure-temperature curve of the fill if the thermostat has been evacuated and sealed so that fill and vapor alone remain in it. The atmospheric pressure line is drawn through the point P at 30″ Hg and parallel to the temperature axis.

Pressure line L is drawn through point S such that the segment PS of the pressure axis is the spring pressure, in inches Hg, of the bellows after assembly and when it is in the collapsed position. This line is drawn this way since, as shown in Fig. 3, the spring pressure acts opposite to the atmospheric pressure and should be subtracted from it. Line L″ is a spring pressure line drawn similarly to Line L and is for a thermostat with a softer bellows inasmuch as PS″ is less than PS.

after evacuation and sealing, there remains in the thermostat a small amount of air, the vapor pressure-temperature curve of the fill will be shifted to the new position A'''B'. The new curve will be of the same shape as curve AB since the residual air pressure will remain approximately constant throughout the temperature range used in this work.

Curve A'A'''B' can be obtained by plotting vapor pressure-temperature values for the fill using line L' as the new temperature axis. Line L' is the residual air pressure in the thermostat and is drawn parallel to the temperature axis through point P', such that OP' is the residual air pressure in inches of mercury.

Essentially, Fig. 4 describes four types of thermostats that can occur in a production run. They are as follows: Type 1. This thermostat has a stiff bellows, contains no residual air and is described in Fig. 4 by points A, B, T_F and T_S. Type is a stat with a soft bellows and contains no residual air. This thermostat is described by points A'', B, T_F, and T_S''. Type 3 is a thermostat with a stiff bellows, with residual air pressure, and is described by point A', B', T_F', and T_S'. Type 4 has a soft bellows, with residual air pressure sealed in with the fill, and is described by points A''', B', T_F' and T_S'''.

The action of a thermostat is usually specified by a statement of the desired starting temperature and the temperature differential. The latter is generally specified as not being greater than a given number of degrees—say 20°F. Let us assume, for the sake of discussion, that Type 1 thermostat meets the specification by having the proper starting temperature, T_S, and the maximum temperature differential, T_F—T_S, allowed.

With this assumption, it is seen that Type 2 thermostat will not meet the specs as far as the starting temperature is concerned. It is a slow stat. Its differential is okay, and it is a good stat, in every other respect, but, because it has a soft bellows, its starting temperature, T_S'', must be higher than specified so that the vapor pressure of the fill may be great enough to start it.

Type 3 theremostat fails to meet the specs with respect to both the starting temperature and the differential. Its starting temperature, T_S', is too low and its differential, T_F'—T_S', is great than T_F—T_S, the maximum allowed. This is a fast stat and is generally termed a "leaker".

Type 4 thermostat comes close to meeting the specs, as seen in the diagram. Depending on the softness of the bellows, the starting temperature, T_S''', and the differential, T_F'—T_S''', can meet or come close to meeting the specification. In the test tanks Type 4 thermostats cannot be identified from Type 1. At this point, it can be observed that the major part of a shipment of thermostats will be Type 4 inasmuch as the softness of the bellows and the residual air pressure will have statistical variation about some mean values.

From Fig. 4, and the preceding discussion, the following general conclusion can be drawn. With a given fill, the softer the bellows the higher will be the starting temperature and the shorter the differential, whereras the greater the residual air pressure the lower will be the starting temperature and the greater the differential.

Previously in this paper, it was stated that there were methods of making slow or fast fills operate a thermostat under specified conditions. The key to the solution is the conclusion just drawn from the preceding discussion. It is obvious that, by manipulating the spring pressure of the bellows and the residual air pressure, a fairly wide range of fills can be used to operate a given thermostat as desired.

Fig. 5 gives experimental confirmation to the more or less theoretical discussion indulged in so far. The data for this diagram was obtained from a set of thermostats, chosen

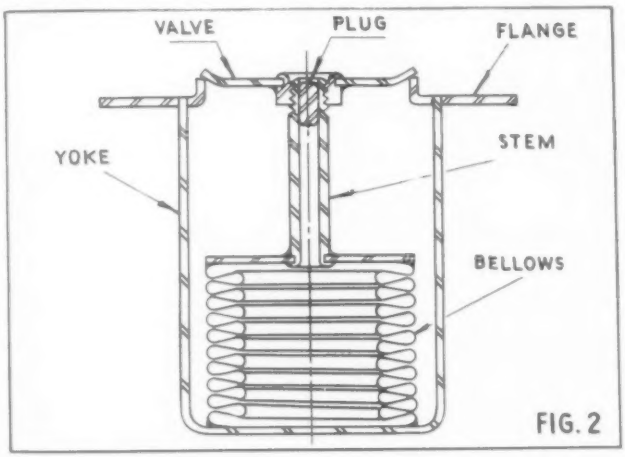


FIG. 2

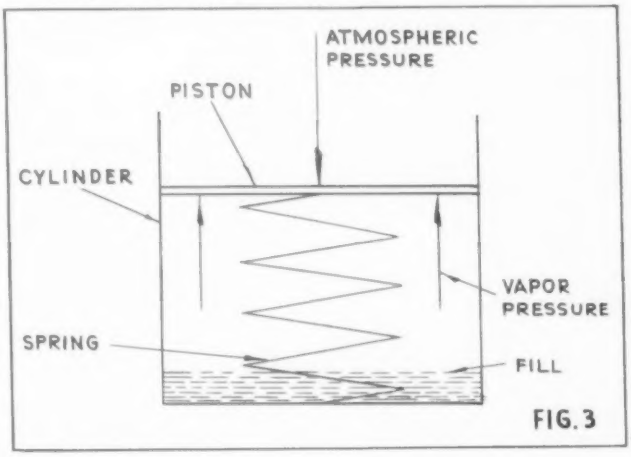


FIG. 3

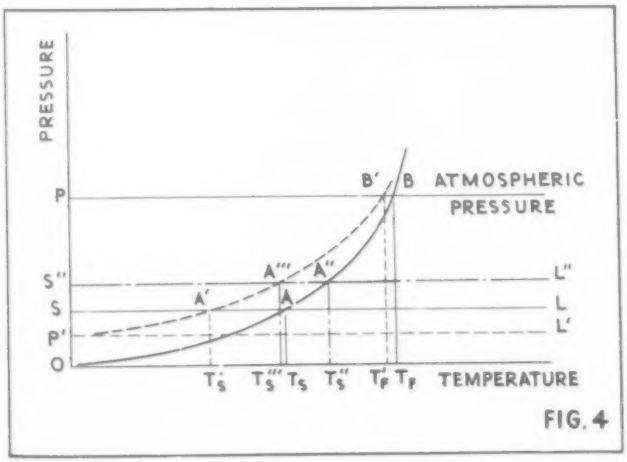


FIG. 4

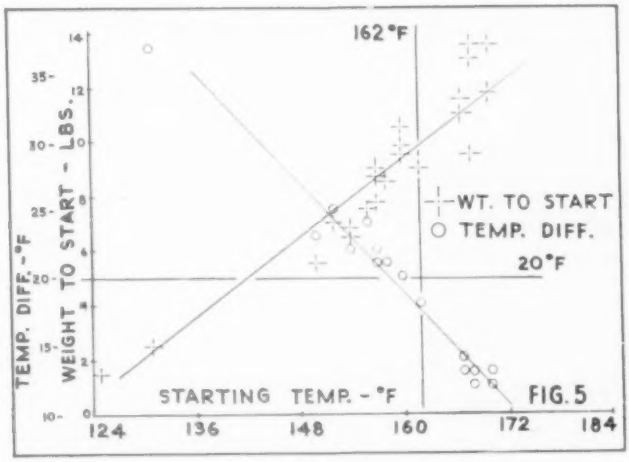


FIG. 5

from a production run so that their starting temperatures covered fairly completely the full range from very slow to very fast. The starting temperature and differential of each of these stats were determined in the inspection tanks and recorded.

Next, the valves were removed so that, under atmospheric pressure, the bellows would settle to its collapsed position. Each thermostat was then inverted in a fixture and weights suspended from the stem until a .0015" feeler would pass between the free folds. This weight was recorded, and the results were termed "weight to start". For each stat, the temperature differential and weight to start were then plotted against the starting temperature to obtain Fig. 5.

The general conclusion to be drawn from this diagram is that, as the weight to start increases, the starting temperature increases and the differential decreases. That this experimentally confirms the conclusion previously drawn is seen by recognizing that the weight to start is proportional to the segment OS" of the pressure axis in Fig. 5, and therefore a function of the spring pressure and the residual air pressure.

The straight lines drawn in Fig. 5 are not intended to indicate a straight line functional relation between "weight to start" vs starting temperature, and temperature differential vs starting temperature. Rather, they emphasize the grouping of the quantities involved since there are, in this diagram, two separate graphs. The production run from which this group of thermostats was taken was made to the following specification for starting temperature, T_s, and temperature differential, $T_f - T_s$: $T_s = 162°F$, and $T_f - T_s = 20°F$.

The lines corresponding to this spec were drawn in Fig. 5 to make it possible to identify the types of stats indicated in Fig 4. Type 3,—the "leakers"—are shown at the extreme left. Here we find a stat such that $T_s' = 130°F$; and $T_f' - T_s' = 38°F$; with ΔT_s being proportional to weight to start $= 2\frac{1}{4}$ lbs. Type 2 thermostats are at the other extreme. Here we see examples with the following properties: $T_s'' = 168°$ approx.; $T_f - T_s'' = 12°F$ approx; with $\Delta'' T_s''$ proportional to weight to start—i. e., 12 lbs. approx.

Types 1 and 4 thermostats are illustrated by those points grouped near the specification lines. Here, we see stats that have approximately the same starting temperatures but have widely differing weights to start and slightly differing temperature differentials. In these stats the spring pressures, plus the residual air pressures, are such that they start opening at approximately the same temperature and have approximately the same full open temperatures as shown by points T_s''', T_s, T_f' and T_f in Fig. 4. The fill used in this production run was specially denatured grain alcohol.

The net results of this paper can be summarized in a few words. Relatively small variations of the spring pressure in the closed position, and in the residual air pressure permitted to seep into or remain in the bellows after plugging, can and does cause individual thermostats to have widely differing behavior. If a large proportion of rejects in any production run is to be eliminated or reduced, then it is imperative that the spring pressure and residual air pressure be under quality control simultaneously.

It was pointed out in a previous section that an attempted control on spring pressure failed because the importance of control of the residual air pressure was not fully recognized. And finally, there is the suggestion that, with quality control established, the inspection tanks—which are cumbersome and expensive at best—can be dispensed with and equipment developed to use "weight to start" as the criterion for regulating and judging the quality of bellows type thermostats.

Letters to the Editors

The Editors,
The Tool Engineer,

First of all I want to congratulate . . . the members of the staff of The Tool Engineer for the fine work you are doing in making our ASTE magazine a real Tool Engineers' publication.

Secondly, I recall reading in the Andy-Grams that you will endeavor to answer requests for information on tooling problems wherever possible. My problem is not primarily a tooling problem but rather one of manufacturing procedure. However, you may be able to furnish me with the desired information.

I would like to learn something about the methods of manufacture of the various types of refrigeration controls such as thermostatic expansion valves. I would like information as to the methods and materials used in charging of the bellows type power units which provide the mechanical action for operating such valves, procedures for constructing and calibrating such vales to meet specific operating characteristics and the methods of testing the finished product.

If you can direct me to a source for the above information, I will be very pleased.

Very truly yours,
H. G. Chapman
Member, Flint Chapter.

A considerable part of the questions raised will be answered in "The Bellows Type Thermostat," an article by John R. Parks which appears above. Incidentally, Mr. Chapman is only one of several readers who have asked for information on this subject.

The Editors.

The Editors,
The Tool Engineer:

Every month, I read with interest and amusement your Andygrams and, in the December issue of The Tool Engineer, was very much interested in what Warren Ames said about using a dial indicator for measuring the thickness of potato chips.

In July, 1931, I sold to the Blue Bird Potato Chip Company, Oakland, California, several dial indicators for this very thing. We found out that, due to the corrosive action of the potato juice, all parts of the indicator had to be made of stainless steel which made them cost like a diamond studded watch. But, in less than 90 days they paid for themselves in material, heat and cooking oil. The knives for slicing the potatoes are set to .001" plus and minus limits.

During the past few years, we have sold dial indicators for many peculiar uses, such as setting rolls for linoleum, soap chips, dried apples and other fruit, leather splinters, and so on, so you see dial indicators are quite important in these lines of manufacture.

Very truly yours,
R. H. Seiple, Manager

The Geometric Dep't,
C. W. Marwedel
(Senior member, Golden Gate Chapter)

Thanks to Mr. Seiple for a very friendly and informative letter. Perhaps we can have opportunity to see some of these applications, and other interesting developments, when the ASTE convenes in Los Angeles in March, 1949.

The Editors.

by **A. E. Rylander**

Fundamentals of Plant Layout

An informal discussion on procedures for diversified and specialized products

Installment No. 2. of a Series on Plant Layout and Materials Handling

HAVING DISCUSSED the simpler elements of plant layout in the previous introductory installment, we will now proceed with more involved studies. In this connection, however, it is suggested that these articles are written primarily for the benefit of readers who are unversed in the procedures for plant layout, rather than for the "experts" who know all about it. Therefore, processes and methods of manufacture will be outlined in greater detail than might ordinarily be necessary, to the end that "lay" readers be the better enabled to reconcile the various elements.

We will start with the layout of a plant for the manufacture of insulated wire and cable. This layout is purposely selected because, for one thing, it embraces a wide diversity of products and processes—wire drawing, cabling, rubber working, the processing of yarns, braiding and so on—and therefore suggests many ideas for plant layout. For another thing, it is a phase of manufacture with which a considerable proportion of tool engineers are unacquainted; hence, it is a diversion from more familiar fields.

Layout For Wire Plant

It is not implied that the layout plan is "ideal" from any viewpoint. Actually, the ideal plant layout is a rare exception rather than the rule; in the majority of cases, the best that one can arrive at is a happy compromise. In this case, a near ideal state would be approached by having all departments on one floor and the whole spread out over a considerable area. Here, however, we are constrained by several considerations, such as a multiple story building and narrow bays—20′-0″—which preclude advantageous location of equipment and the easy flow of materials that could be affected with wide bays.

Before we discuss layout, however, it may be well to introduce the various elements that comprise the main product and the processes for their manufacture. Only six basic elements—or rather, combinations of elements—enter into the product. These are:
(a) Copper; (b) rubber (or enamel or yarn) for insulation; (c) yarn, jute and fabric (tape) used for covering; (d) saturating compounds (wax, asphalt, varnish and lacquer); (e) armor, such as half-round wire for automotive wires (now largely obsolete) and flat steel tape, for parkway cable and flexible conduit; and (f) lead, largely used for underground cables. Dyes, for coloring yarn, are also used but is an incidental element. The major elements are processed as follows:

Copper. This is received in rods, which are in turn reduced through heavy, medium and light draw benches to the required sizes, of which No. 14 solid would probably predominate. It is annealed between draws, and sometimes after the final draw. Hard wire is not annealed after the final draw. When so specified it may be tinned, in which case it is first run through a pickling bath. After drawing and /or tinning, it may go to stranding or directly to the tubers for rubber covering. Some wires are insulated with a special, heating resistant and nonscaling or cracking enamel.

Rubber. This is compounded from crude rubber (latex or synthetic), sulphur, shoddy (scrap rubber) and other materials, and progresses in turn through a masticator, a mixer, a strainer and a rubber mill. The latter comprises two heated rolls, running at slightly different surface speeds, between which the rubber is thoroughly kneaded into a homogenous, doughy sheet. It is then cut into strips, or diced, after which it goes to the tubers, where it is extruded around the wire or stranded cable, as the case may be.

When tubing (or rubber covering) the wire is unwound from a reel, is then threaded through a hole, which closely fits the wire to prevent the rubber from backing out, and through a die the size of which corresponds to the desired O.D. of the covering. The rubber is laid on under pressure. On emerging from the tuber, the covered wire is dusted with talc, to prevent adhesion, and is then wound up on a reel.

It is next subjected to a high voltage test, during which the reel is submerged in a tank of water. Weak spots, if any, will "blow" during the test, and these weak places will then be spot repaired. After inspection, the wire goes to the vulcanizers for curing. After vulcanizing, it may be further processed (as will be explained later) or, if it is to be rubber covered only, it may merely be subsequently polished and then shipped.

Yarn. This may be cotton or a synthetic, as rayon, to be stored as received until requisitioned. In processing, it is first "conditioned"—i.e., subjected to moisture, then washed

Typical of modern industrial buildings is the plant of Pyramid Moudlings, Inc., Chicago, Ill.

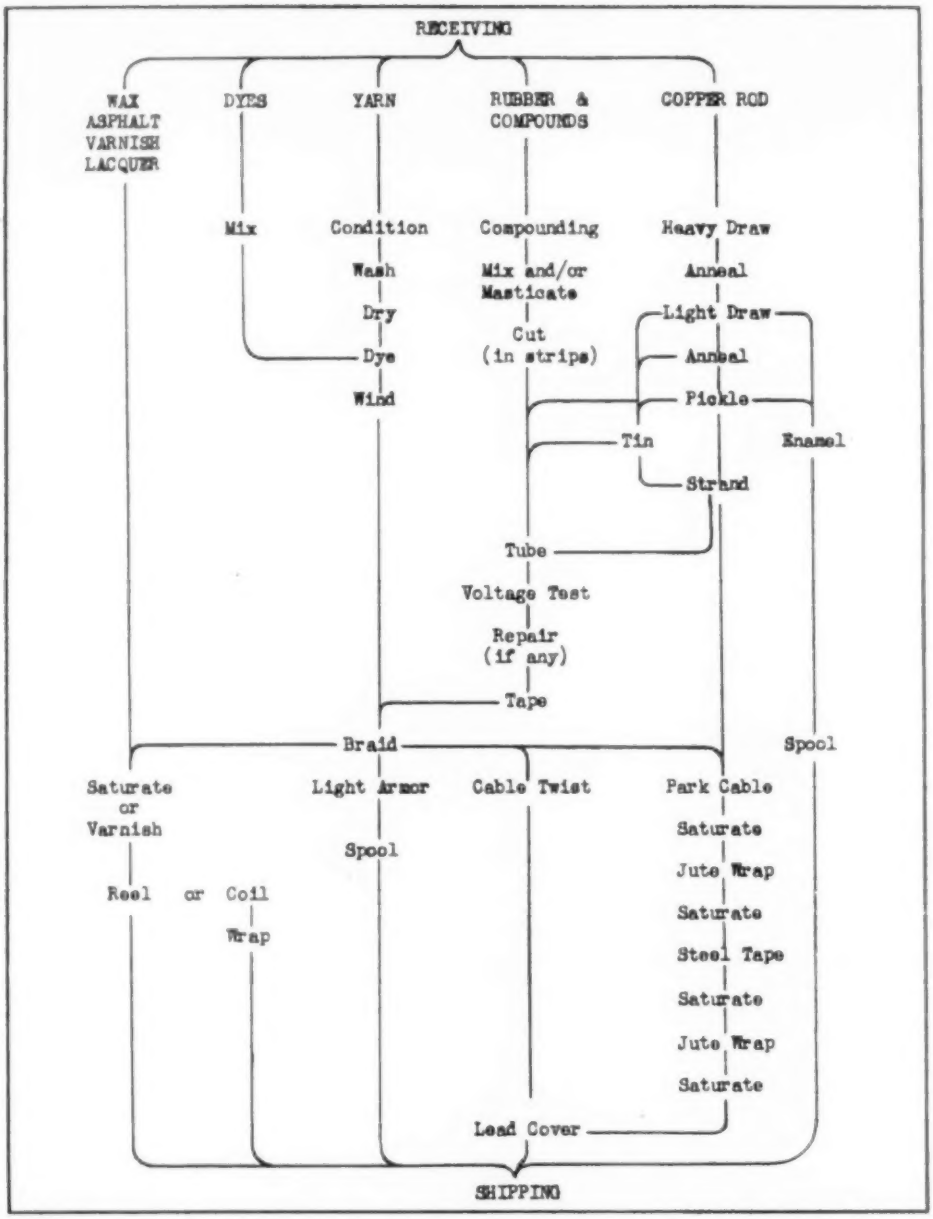


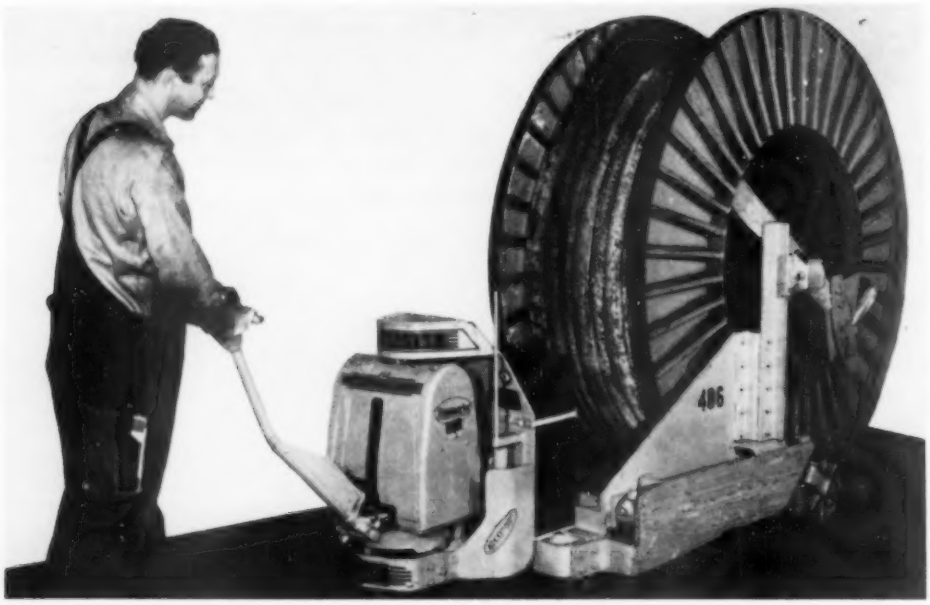
Fig. 4. Flow diagram for the manufacture of insulated wire and cable.

and dried, then, unless white is specified, dyed. After drying, it may be glazed with sizing; in any event, it is spooled on Universal winders and then stored until requisitioned for braiding. Usually, before braiding, the wire is wound with tape, which is wrapped directly over the rubber covering previously described. The tape may be ordinary friction tape, glazed fabric or even paper, depending on requirements. The purpose of jute will be explained later.

Saturating Compounds. Stored as received until requisitioned. When saturating, the wire (which is now braid covered) is run through a long, trough-like tank, in which the heated compound is kept agitated to prevent solids from settling. Here, the compound may be wax or asphalt, as specified. On emerging from the tank, it passes through a wiper and a polishing head, and is then reeled ready for shipping. Wire for house wiring—as No. 14 solid—is coiled and then machine wrapped with a tough paper, when it goes to shipping.

Wire to be enameled, lacquered or varnished is drawn through a container, charged under pressure and provided with entering and outgoing holes which fit the wire closely to prevent leakage. Superficially, this process is similar to tubing. On emerging, the wire is either wound around a huge spider, for air drying, or, it may be passed (vertically) through a heated duct for drying. It is then reeled, coiled or spooled, as specified, ready for shipping.

Armor. As previously explained, this may be half-round steel wire—say about $\frac{1}{16}'' \times \frac{1}{64}''$ in section—or flat steel tape. It is stored as received until requisitioned. For light armoring, the wire—which has been previously braided and varnished—is drawn through a hollow, rapidly rotating spin-



A large reel of heavy insulated cable is shown being handled by a Transporter motorized truck product of Automatic Transportation Company, Chicago. The operator is lifting the reel with the truck's electric lift, after which the reel can be moved or unwound. Trucks of this type are also used for servicing banks of heavy braiding machines.

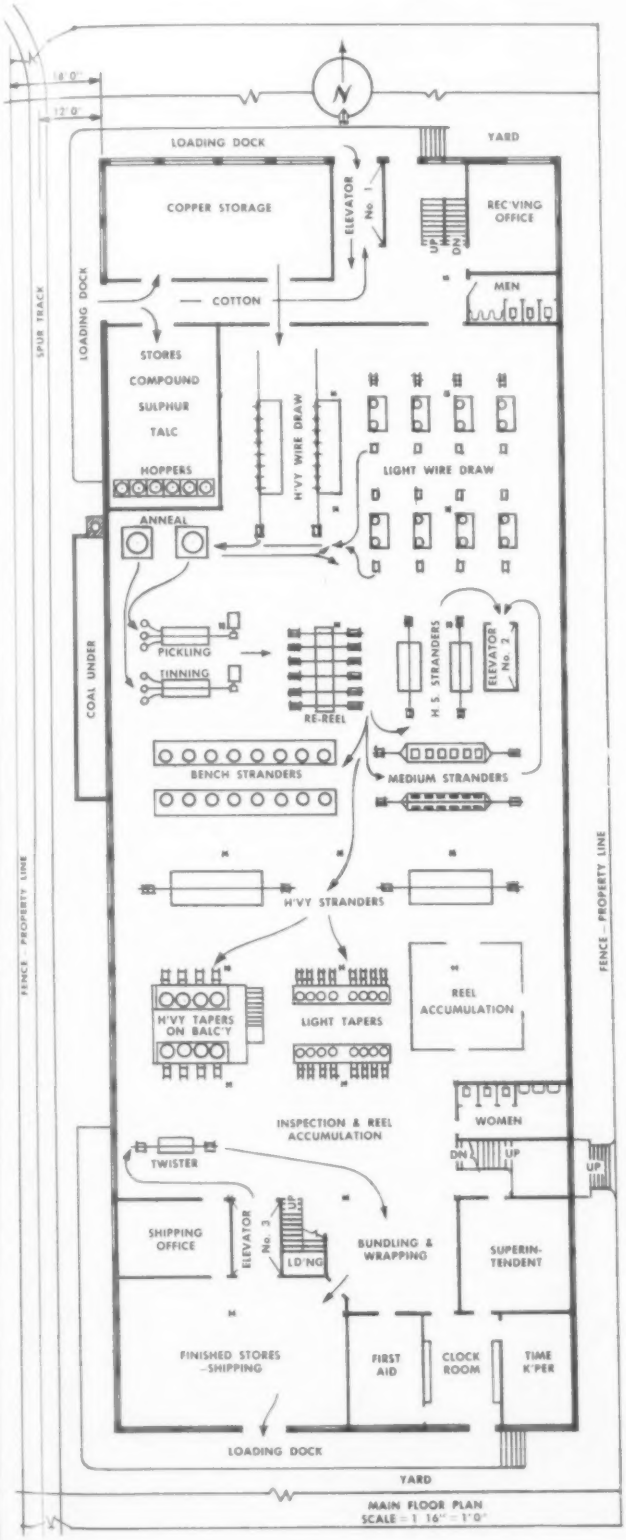
dle t which is attached a flyer. The armor comes wound up o a spool, the hole of which just fits the O.D. of the spind The spool is therefore slipped onto the spindle, when he armor is threaded through an eye in the flyer and then rapped around the wire. Speed of pull-out—i.e., the feed- s geared to the width of the armor.

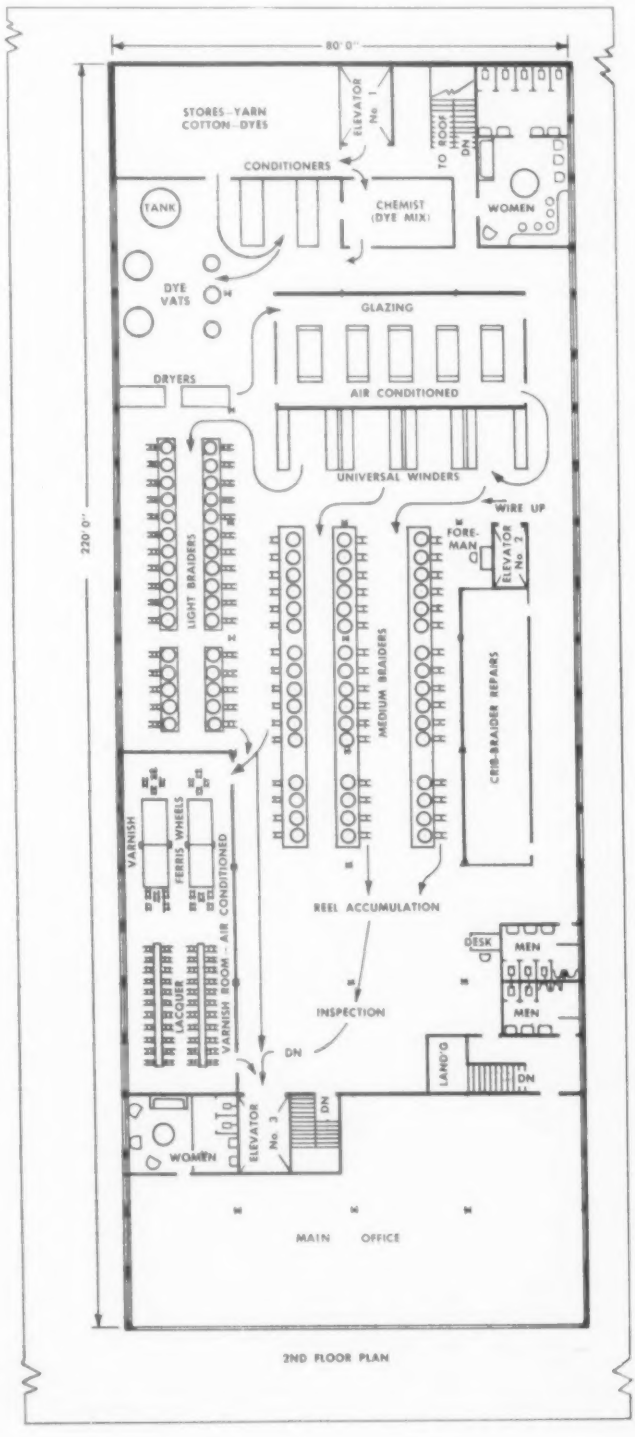
Fl steel tape is used mainly for two purposes:—(1) for flexib conduit, when it is formed into an irregular S shape and en curled through dies to make the flexible tubing, and (2) for park cable. Since we are not concerned, here, with the flexible conduit, we will confine ourselves to a brief description of parkway cable.

The wire is drawn, stranded, rubber covered, taped and braided as previously described. It is then run through a saturating solution, then wrapped with a layer of jute, which is saturated in turn. It is next wrapped with a layer of steel tape, which is then saturated and jute wound and subjected to a final saturation.

It is finally lead covered, as will be outlined below. It should be explained, however, that the jute serves the purpose of a cushion between the rubber covered wire and the steel tape, and between the latter and the lead covering, to

Fig. 5a, at left, and Fig. 5b, below, show respectively the main floor and 2nd. story of plant for manufacture of insulated wire and cable. Flow of materials is indicated by arrows. Drawings are proportioned to scale 1/16" = 1'-0".





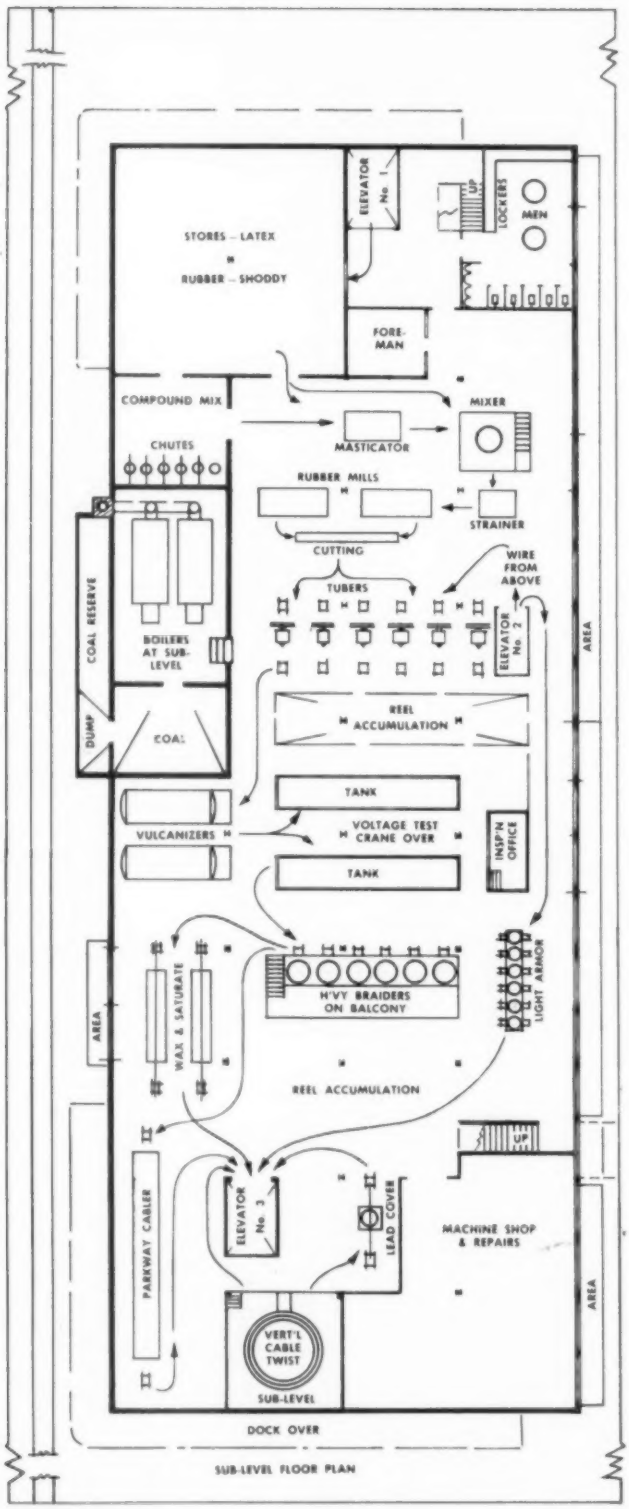


Fig. 5c. basement floor plan of plant for manufacture of insulated wire and cable. Flow lines on all floors are progressively from north to south. Vulcanizers and the vertical cable twister are at sub-level to facilitate loading and loading.

Fig. 6, below, shows medium stranders disposed in tandem. The stranded cable, from the machine at left, forms the core for the stranding at right.

Fig. 7. Showing how stranders may be double (or triple) decked to conserve floor space. While not so shown, a balcony may be necessary for purpose of serving the upper machine or machines.

prevent chafing. The steel tape protects the wire from accidental cutting, as with a spade or trench digger, and the jute and lead covering are for moisture proofing.

Lead. This is received in pigs and stored until requisitioned. The lead covering is an extrusion process, largely similar to rubber covering in that the cable enters through one hole, of exact size, and emerges through a die which determines the O.D. of the lead sheath. The lead, contained in a pot, is heated to a plastic state and solidifies while emerging from the die. It is then wound up on large reels, ready for shipping.

The reader should now have a fairly clear idea of the processes involved, and can therefore the more intelligently follow the procedures for plant layout. In this connection, it will have been noted that many operations are by-passed —i.e., stations will be skipped depending on the end-purpose of the product. All this is shown quite clearly in the flow diagram, Fig. 4.

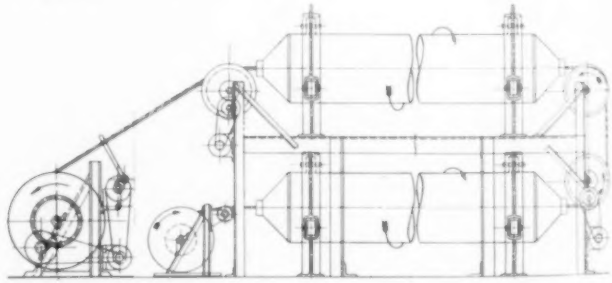
As previously stated, we are somewhat handicapped, in making our plant layout, by the nature of the building. The building—Fig. 5, a, b, and c—is nominally 2-story, with what may be termed a basement at sub-level. The heaviest work is done on the basement floor, which also houses the boilers, vulcanizers and test tanks, all in turn at sub-level, as is one of the machines, a cable twister. Intermediate work is done on the main floor and light work on the upper floor, which also contains the general offices.

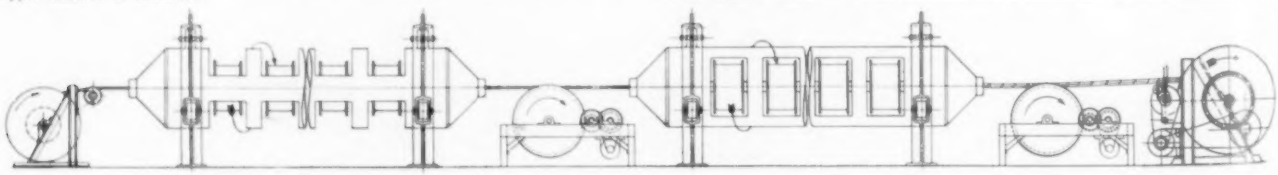
Practically Straight Line Flow

Sketchily outlining the flow of materials, all raw materials —copper rod, rubber, yarn, compounds and so on—enter at Receiving, located at the north of the building. Shipping is at the south end, and both are served by a spur track, with loading docks disposed for both rail and truck service. A coal dump, with fuel reserve, is located adjacent to the tracks and easily accessible from the boiler room.

An evident disadvantage is the location of the Receiving office; this, however, is a compromise with the need for adequate storage space for copper and compounds on the main floor. An elevator (No. 1) carries yarns and dyes to the upper floor, and crude rubber, shoddy and other materials to the basement. This elevator—the largest of three—also serves for transport of equipment from floor to floor. Compounds are dropped, via chutes, to the mixing floor below.

Despite the disadvantage of the three floors, and the narrow bays, it will be seen that the flow of materials is along fairly easy lines and entails a minimum of trucking. For example, Elevator No. 2 is so situated that wire can be brought to the upper floor for light braiding, or, yarn may be brought from the winders down to the intermediate braiders on the main floor, or to the heavy braiders in the basement. All finished materials may be brought directly to Shipping via elevator No. 3.

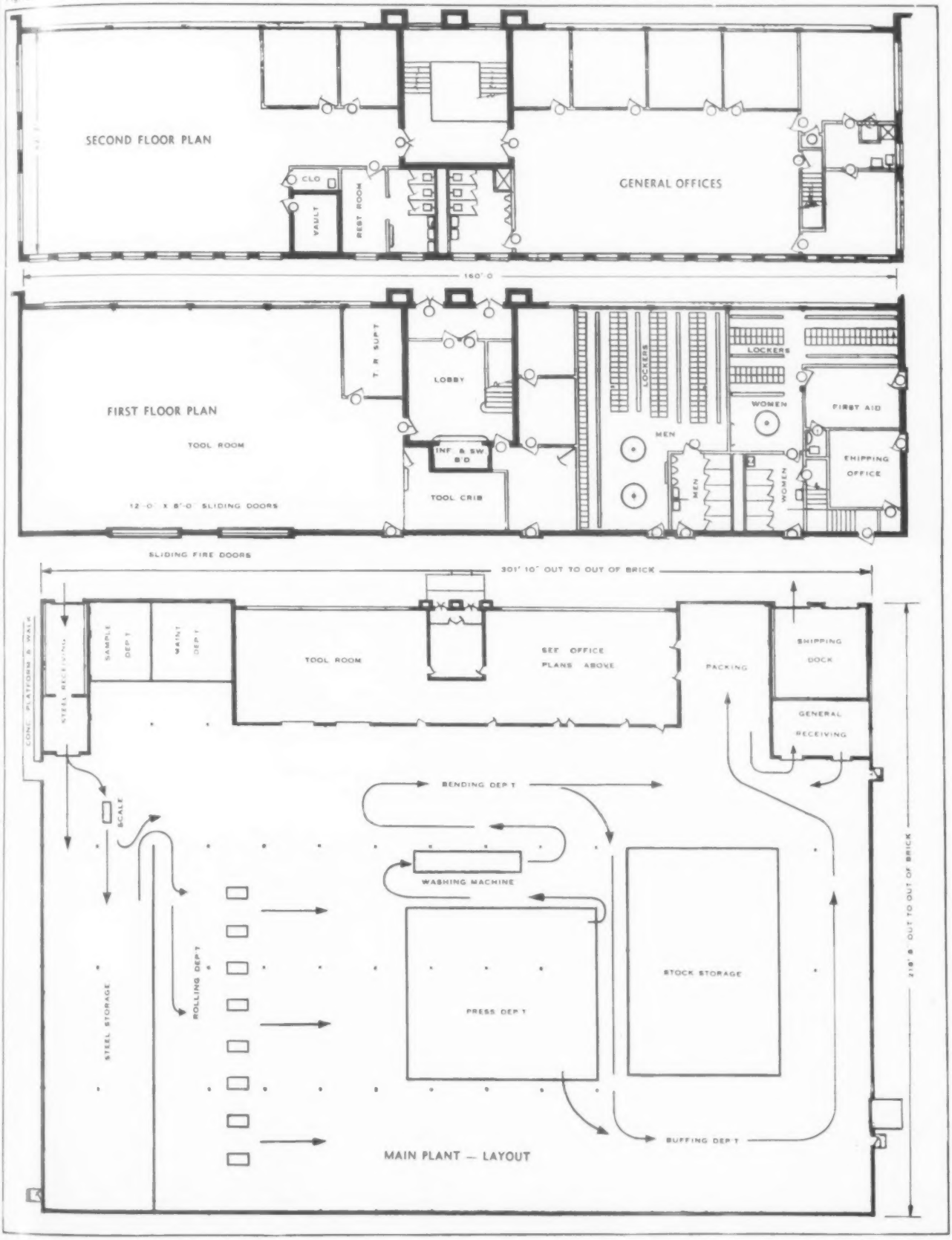




Summing up the flow, elevator No. 1 serves for raw materials and for transport of equipment; elevator No. 2 provides a meeting point for work which may be done on any of the three floors, while elevator No. 3 serves to bring all material to Shipping in addition to serving as a shuttle for work in process. The flow of materials is progressively from north to south, interrupted only by vertical (via elevator) portage when such is necessary.

In the manufacture of wire, the handling of materials is at once a simple and yet a fairly involved problem. Simple

Fig. 8. Floor plan with flow of materials, Pyramid Mouldings, Inc., Chicago, Ill. This ultra-modern plant is typical of postwar industrial buildings.



because, once drawn, the wire is usually wound up on reels which may be easily rolled, from station to station. For small reels, a U shaped rod, of which one leg serves as an axle and the other as a handle, is pushed through a hole in the reel and the whole wheeled to its next station.

While conveyors may be advantageously used, in many instances, equipment is usually so disposed that only an accumulation area is required between the various stations. See the floor plans. There is, of course, considerable trucking, as of lead, coiled wire, spools and so on, and this is generally taken care of with hand trucks or powered lift trucks. Heavy reels are moved by specially designed trucks, one type of which is illustrated in this installment.

What complicates the problem is that, in view of the many processes to which the wire may be subjected, many of the stations must be by-passed as stated above. Here, conveyors are especially advantageous; for that matter, vertical conveyors could be used, instead of elevators, for transporting loaded reels from floor to floor. Thus, one would have a more or less continuous flow. The essential consideration is that the conveyor would have to be very rugged since, with a loaded 36″ reel weighing up to 2800 pounds, several would impose a very heavy load on chains and driving mechanism.

Whether the product be wire or other goods, the plant layout engineer can take advantage of many improvizations to conserve floor space. In this case, for instance, heavy braiders and tapers are disposed on balconies; thus, the take-up reels are immediately below the pull-out, thereby taking up only one half the floor space ordinarily required. Such disposal will be expanded on in a later installment.

When stranding wire, it is sometimes necessary to impose several lays, one over the other, when the stranders are disposed in tandem. However, they can be advantageously double or triple decked, thus putting several machines in the place ordinarily allocated to one. This method is illustrated (Figs. 6 and 7) although it might be added that it may be necessary to provide a balcony from which the operator may service the upper machines.

As previously intimated, the ideal plant layout is the exception rather than the rule. And, when the ideal condition is approached, it will usually be found that the plant is of recent construction with buildings designed to suit the product of manufacture. Typical of this latter-day planning is the plant of Pyramid Mouldings, Inc., 5353 W. Armstrong Ave., Chicago, the floor space of which is shown in Fig. 8. This is definitely a postwar plant, as modern as tomorrow.

Both Receiving and Shipping front on the street and each is served by an enclosed, ramped loading dock. Thus trucks do not constitute a traffic hazard except for the brief interval of backing in and pulling out—a minor consideration in this case. These departments form the legs of a U, with the general offices (on the 2nd floor), the offices of supervisory personnel, tool room and comfort facilities (lower floor) in between. The main plant is single story.

Steel enters at Receiving, passes in a straight line to the scales and steel storage, and from there progressively through to Shipping. There is some zigzagging as certain operations are by-passed or diverted; otherwise the flow of materials is straight line to all practical purposes.

Steel is received in coils of various widths and is roll-sheared to required widths just prior to forming in the rolling mills. The latter are entirely automatic and tooled with exquisite exactness. One interesting operation, for example, is the forming of polygon tubes—hexagon, octagon and up—which are then automatically cut to length, as the shapes emerge, with barely a trace of burr.

End shapes are formed in presses, and certain assembly operations—as well as small stampings—are also done in the press department. The mouldings are then washed, to remove oil and grease, when they go to buffing. It might seem, from a superficial glance at the layout that the washer is not advantageously disposed in relation to the rolling mills. However, it may be pointed out that many of the mouldings are quite long, that they come out of the mills at high speed, and that safety measures must be incorporated to prevent injury to workers passing by. Considering the various factors involved, the layout is extremely efficient.

The buffing department is remarkable for its simple yet efficient tooling and forethought toward operator safety. Holding fixtures are designed for quick loading and unloading and are practically self feeding. A unique system of racking separates the molded shapes, which are then packed, with interposed strips of paper to prevent marring, and boxed ready for shipping. The work is so coordinated that there is very little accumulation despite the great variety of shapes and lengths produced.

We have, here, shown two typical plant layouts for diversified products. In the next installment, we will discuss procedures for plant layout, together with more advanced layouts of typical plants.

END OF INSTALLMENT NO. 2, this Series. Installment No. 3 will follow in March, The Tool Engineer.

Wide Industrial Uses for Fume Separator

AFTER CONSIDERABLE experimenting with methods for purifying air without loss of room heat and resort to expensive ductwork, two brothers—Carl and William Niehaus of Indianapolis—developed a fume separator which cleans by water absorption and centrifugal action. Requiring a minimum of ductwork and making installation simple and inexpensive, the unit as developed returns pure air to the shop without undue waste of heat.

While primarily designed for use in their electroplating plant, with only a remote thought of manufacture for sale, a model was displayed at the annual convention of the American Electroplaters Society in Detroit, in 1947. This aroused such interest that it inspired a nation-wide distributing organization. As a result, the purifier is now available to industry.

Originally developed to draw contaminated air from electroplating tanks, the air cleaner may be applied to a wide variety of other uses, as, for example, for control of fumes from such solutions as anodizing, chromic acid, caustic soda, caustic oxydizing, sulphuric acid, and all cyanide solutions. It may also be used for the control of fumes from ceramic paints, alkaline solutions, paint spray booths and pickling tanks in wire plants and steel products shops.

by James Walker

Procedures for Drawing Flanged Shells

Difficult problems of drawing solved by applications of fundamentals to design

Concluding Installment of a Series on Drawing Die Problems and Formulae

UP TO THIS TIME, the drawing of flanged shells has purposely been omitted from this series, the reason being that the methods for computing reduction and designing the tools vary somewhat from those used for flangeless shells.

From previous examples, it should be evident that, to reduce a blank 3.000" diameter to a cup 2.000" diameter x 5/8" high (a 33% reduction) would be quite simple. If, however, an inch flange were added to the periphery of the cup, then, two operations would be required to produce it. This is due to the fact that, if attempted in one draw, the bottom of the cup would rupture because of the additional pressure necessary to prevent the formation of wrinkles.

Add still another inch flange and three operations would be necessary to produce a flanged shell. This fact is often overlooked; however, it will become obvious if the blank diameter and the percentage of reduction are computed previous to designing the tools.

Formulas for Computing Shells

The reductions for both flanged and flangeless shells are computed as follows: Assuming that the material thickness is average, and that the radii of the drawn shape are so small that they may be neglected, then, the formula most generally used for flangeless shells is: $P = \sqrt{d + 4dh}$

In which P equals the blank diameter, d equals the diameter of the shell (or cup), and h equals the height of the shell. To cite a simple example, assume a cup whose diameter is 2" and its height 5/8", then: $D = \sqrt{d\,p + s\,4dh}$

$D = \sqrt{4\,p + s\,4 \times 2 \times .625}$, and

3.000"	(blank diameter)
—2.000"	(cup diameter)
1.000"	(their difference)

Thus, the percentage of reduction = 3.000/1.000 = 33%.

But, add one inch of flange to the periphery of the cup and the formula becomes: $D = \sqrt{d^2 + 4\,d_1\,h}$

In which d^2 equals the flange diameter, d_1 equals the cup diameter, and h equals the height of the shell. Then:

$D = \sqrt{4 + 4 \times 2 \times .625}$

$D = \sqrt{16 + 5}$

$D = \sqrt{21}$

D = 4.583, and

4.583	(blank diameter)
2.000	(shell diameter)
2.583	(their difference)

Thus, the percentage of reduction equals 4.583/2.583 = 56% reduction, which necessitates two operations. If, however, one more inch of flange is added without changing either the diameter of the cup or its height, the reduction becomes 68%, necessitating three operations.

When designing drawing dies for flanged shells that require more than one operation, there are three appropriate methods to follow. The first method pertains to shells that are wide in proportion to their flange, such as shown in Fig. 1, at a, b, c and d.

First, blank and draw a flanged cup. Then, by a series of operations reduce the diameter of the cup but, at the same time, maintain the original diameter of the flange produced by the first draw. The diameter of the flange is controlled by adjusting the ram of the press just far enough so that the flange diameter remains constant.

By examining the parts drawing, Fig. 1 a, b, c, d, it will be noted that each time the radius is decreased, the depth is increased. For the first draw, use 7t* radius for the die and a 6t radius for the punch. The radii for the succeeding operations should be 4t to 5t for the second draw and 2t for the final draw. In cases where a 1t radius is required, add another operation.

The design of tools to produce a flanged shell such as shown in Fig. 1 are detailed in Figs. 4, 5, 6 and 7. Figs. 4, 5 and 6 are appropriate for relatively thick materials and, in the event that a thin material is used, modify the design as shown in Fig. 7 by adding a drawing sleeve.

The preceding dies (of large radii) are concerned particularly with the drawing of non-ferrous materials because, if the tools are made with inadequate radii, they will imbed themselves in the material and cannot be removed in further operations. The cross section of the actual parts, as drawn, is shown in Fig. 1-d.

Wide and Deep Shells

The second method concerns shells that are both wide and deep, as shown in Fig. 2 at a and b. An appropriate design, for the tools, would be such as shown in Figs. 8 and 9. The first and second operations would be produced as previously described in Figs. 4, 5, 6 and 7, the third operation would taper the shells as shown in Fig. 8, the fourth operation would finally form as shown in Fig. 9, and the final trimming operation would be produced by the die shown in Fig. 10.

The third method pertains to flanged shells of relatively thick material that are deep in proportion to their flange, as shown in Fig. 3. The dies should be constructed as shown in Fig. 11 at a, b, c, and d. This type shell is first produced as a cup with a 6t radius, then shaped in successive operations by gradually forming the flange. In the final operation the shell is sized and the flange is "spanked" in by bottoming the punch and die. If the material is relatively thin, then incorporate the drawing sleeve as previously described.

Fig. 12 shows the die that was used to produce the shape shown in place. This is typical of open die construction and is practical for large bottom radiused and hemispherical shapes. As previously implied, tremendous blank holding pressure is required for holding such shapes because of the unsupported metal between the draw-ring and the point of contact of the punch. Such a condition influences puckering, and the pressure necessary to prevent it influences rupturing.

*t = thickness of material

Fig. 13 illustrates the die for the first of a sequence of operations—draw and emboss—used to produce the drawn shape shown in place. Also shown (in Fig. 13 a) is the punch proper and the sectional embossing inserts mounted to its face. The sectional inserts were shaped and mounted as shown and were secured by cap screws and dowels. The inserts were of sectional construction because, if made in one piece, it would not only be difficult to heat treat but would present a difficult task of machining and fitting.

In operation, as the press descends, the blank is clamped between the face of the die and the pressure-ring that extends above the punch inserts. At the bottom of the stroke, the embossing is "spanked in". In the second operation, the right hand drawn dimple was pierced and sized, then progressed to the locator on the right side of the die. This locator positioned the part so that the chordal tolerance was maintained while the left hand drawn dimple was pierced and sized. These operations, and the final trimming operation of the flange, are not shown. Die construction is shown in Fig. 14.

3—Stage Draw Dies

An appropriate design for a three-stage draw die is illustrated in Figs. 15, 16 and 17. Such a construction is economical for low production inasmuch as the first and second operations are produced in one die. The construction of the die shown in Fig. 17 makes possible two operations.

The first operation is performed with the shim in place; the second operation (Fig. 16) is performed by removing the

Figs. 1, 2 and 3 show, respectively shells that are wide in relation to flange; shells that are both wide and deep; and flanged shells of relatively thick material that are deep in proportion to the flange. Designs of dies for shells shown in Fig. 1 are indicated in Figs. 4, 5, 6 and 7. The third operation would taper the shells as shown in Fig. 8, with final forming and final trimming operations shown in the two dies Figs. 9 and 10, respectively.

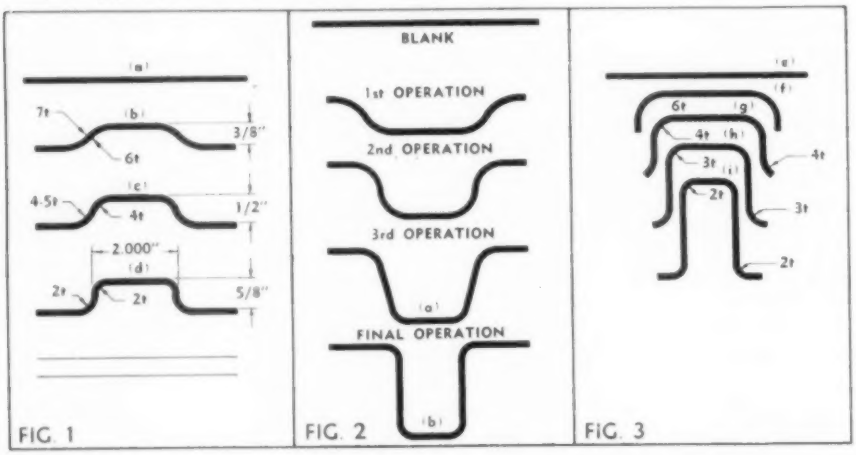


FIG. 1

FIG. 2

FIG. 3

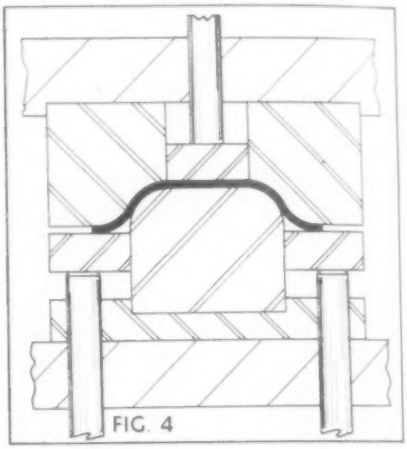


FIG. 4

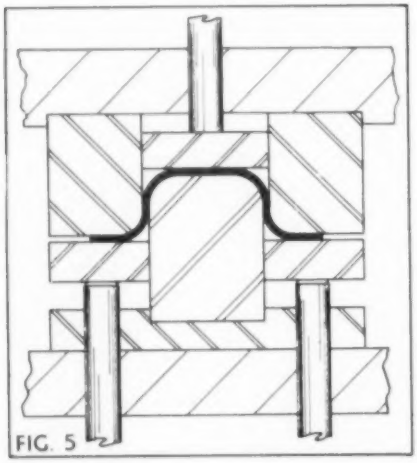


FIG. 5

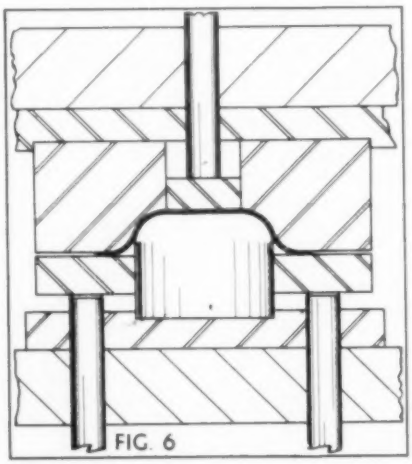


FIG. 6

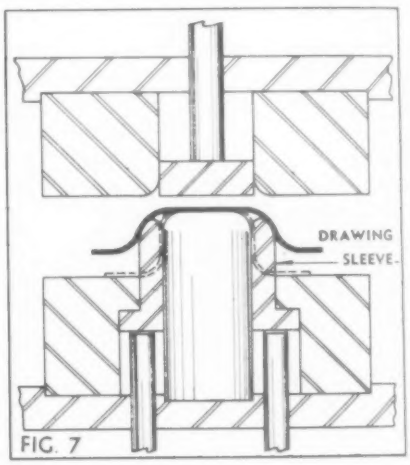


FIG. 7

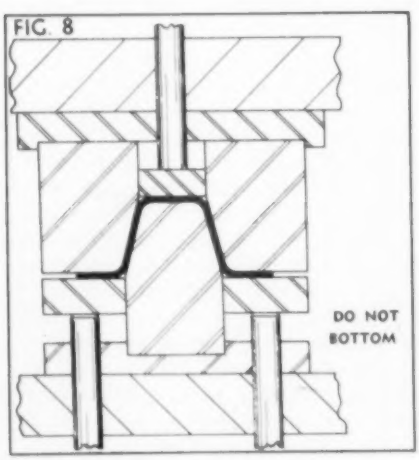


FIG. 8

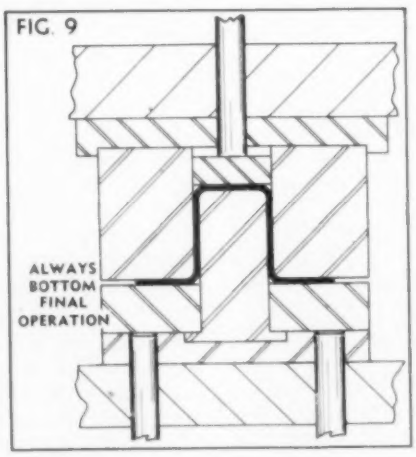


FIG. 9

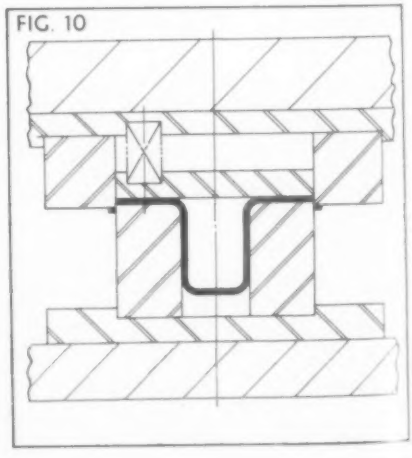


FIG. 10

Figs. 11-A, 11-B, 11-C and 11-D show how dies should be constructed to draw shells of relatively thick material, as indicated in Fig. 3, page 38. Fig. 12 (at bottom) shows the die used to form the part shown in place. Of open construction, this die is practical for parts of hemispherical shape and having large radii.

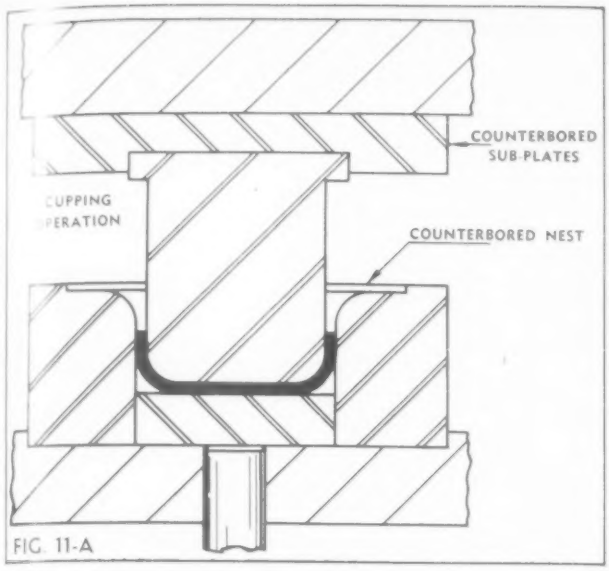


FIG. 11-A

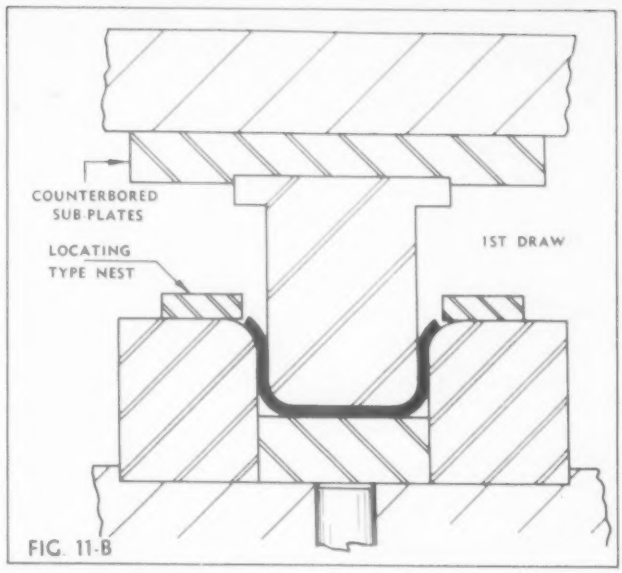


FIG. 11-B

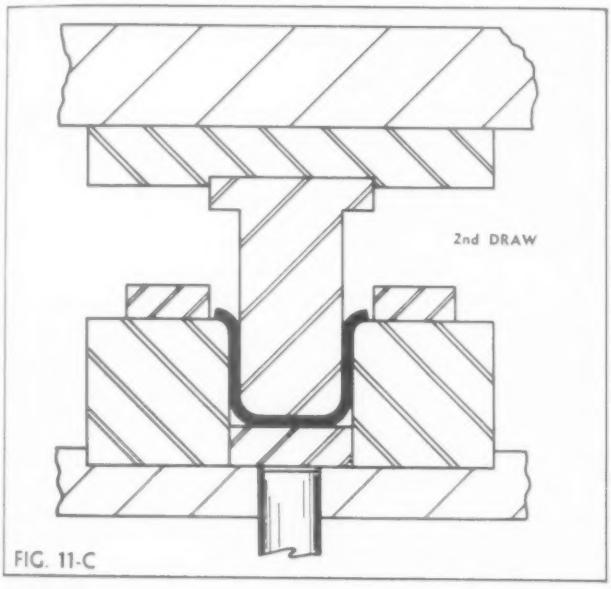


FIG. 11-C

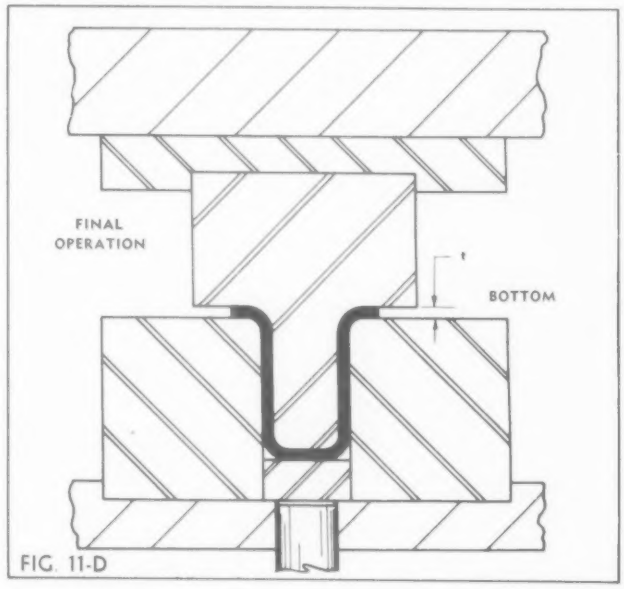


FIG. 11-D

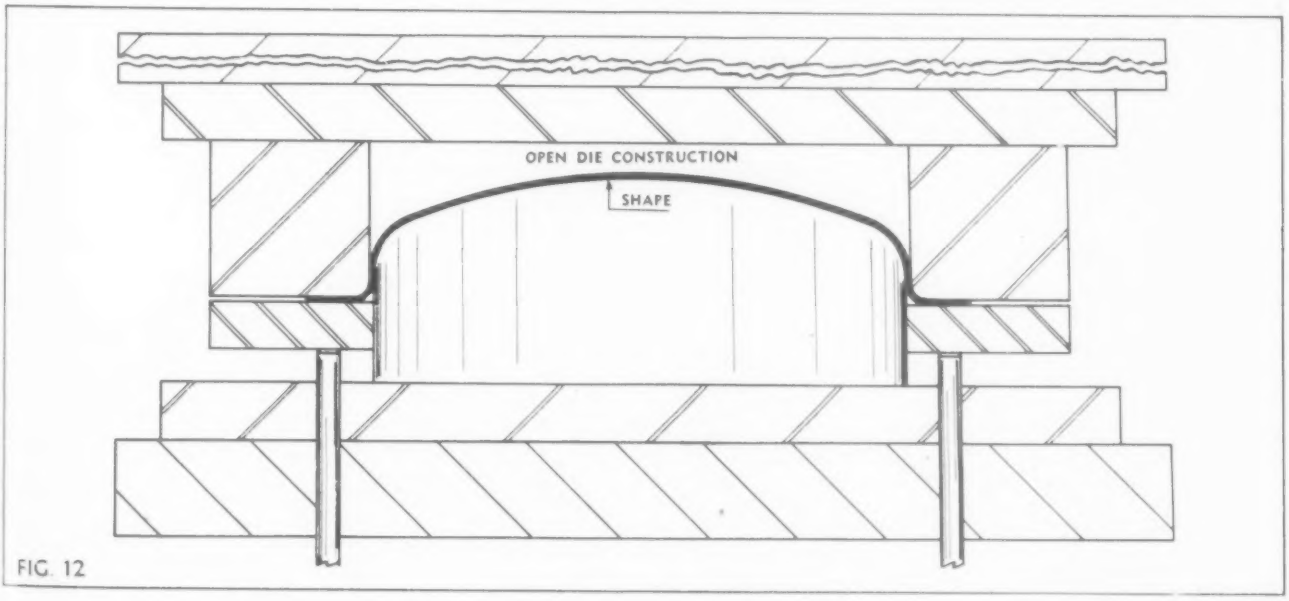


FIG. 12

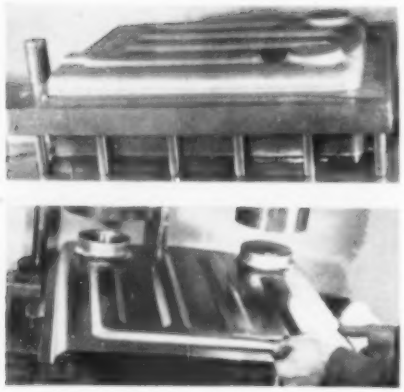
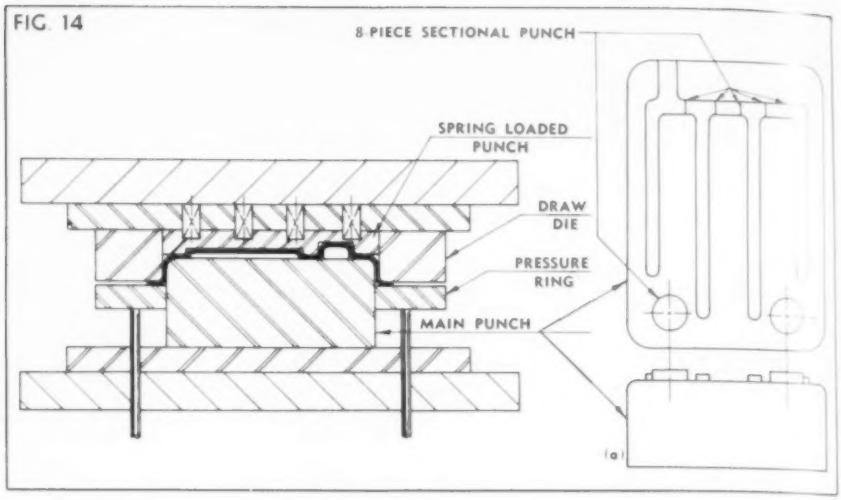


Fig. 13-a (top) and Fig 13-b (bottom) shows the die for the first of a sequence of operations for producing the part in lower photo. Construction is shown in the line drawing, Fig. 14 at right.

FIG. 14



shim. The third operation completes the flanged cup and the die is shown in Fig. 16. Obviously, the construction described is recommended for limited production runs since, as three dies in as many presses would be used for high production runs, the first die should be of the combination type—i.e., blank and cup—and set up in an open-back inclinable press. The actual part is shown in place, Fig. 17.

Fig. 18 illustrates a die for a rather intricate drawing operation. The die was constructed from a solid piece and laid out symmetrically to produce two parts (shown in inset) with each stroke of the press. This particular type contour is best accomplished by the construction illustrated because, if one part were drawn at a time, the unequal depths would present a difficult problem if drawn separately in one operation.

Note the two beads, shown lengthwise in the part drawing, that run lengthwise in the die. These beads represent blank-holding pressure and aid in preventing excessive wrinkles. Both the punch and the knockout were of sectional construction which facilitated the machining of these parts.

Figs. 19 and 20 illustrate another intricate drawing operation. The first operation is shown in Fig. 19 and the second

Figs. 15, 16 and 17 show construction of dies for a 3-stage drawing operation of the part shown in place, Fig. 17. Fig. 18 illustrates a die for an intricate drawing operation. The die was constructed to produce two parts, shown in inset, at each stroke of the press. In this case, unequal depths would have created an acute drawing problem.

FIG. 15

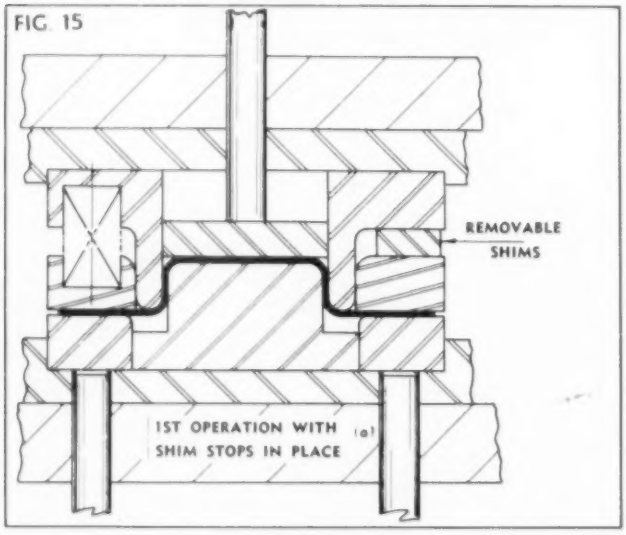
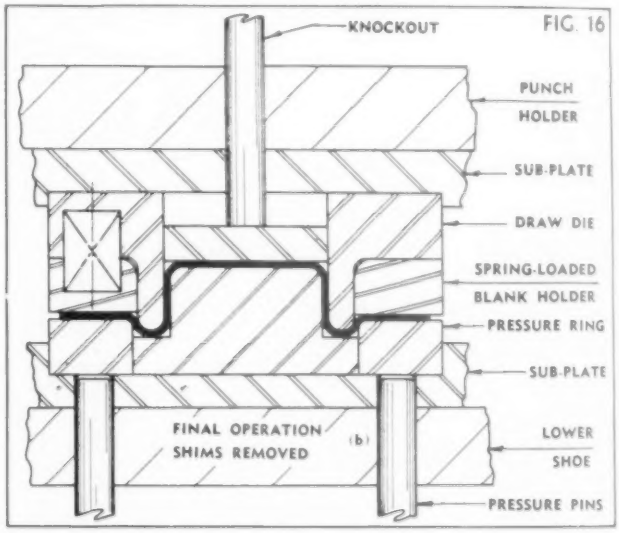


FIG. 16



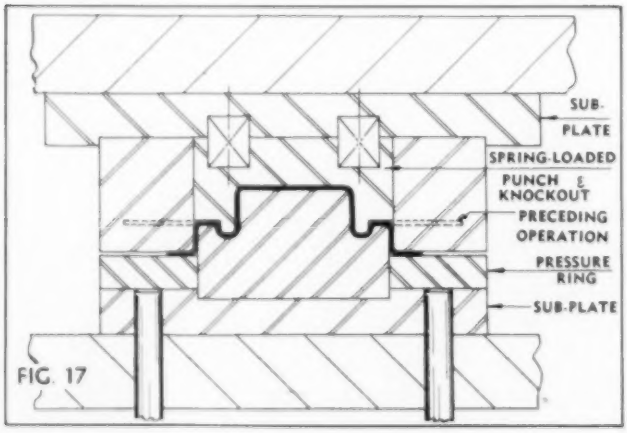


FIG. 17

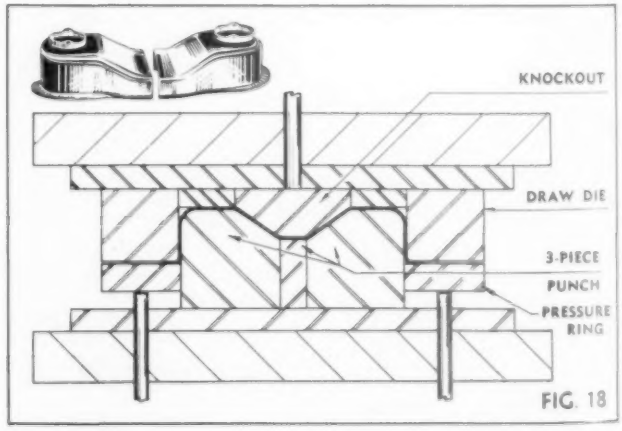


FIG. 18

operation is clearly illustrated in Fig. 20. In operation, the spring-loaded knockout contacts the preformed central portion of the blank and, at the same time, the edges of the blank are confined within the faces of the draw and pressure ring, thus keeping the metal under control during the entire press cycle.

Figs. 21 and 22 illustrate an unusual contour that was accomplished in three operations. The first operation employed a combination die (not shown) while the second and third operations were completed by the dies shown. As will be noted, the part is inverted—i.e., upside down in relation to Fig. 21—in the final operation.

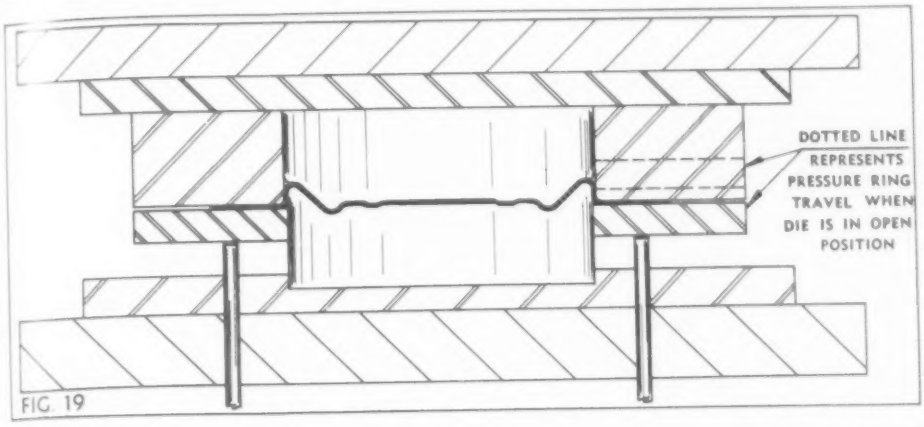


FIG. 19

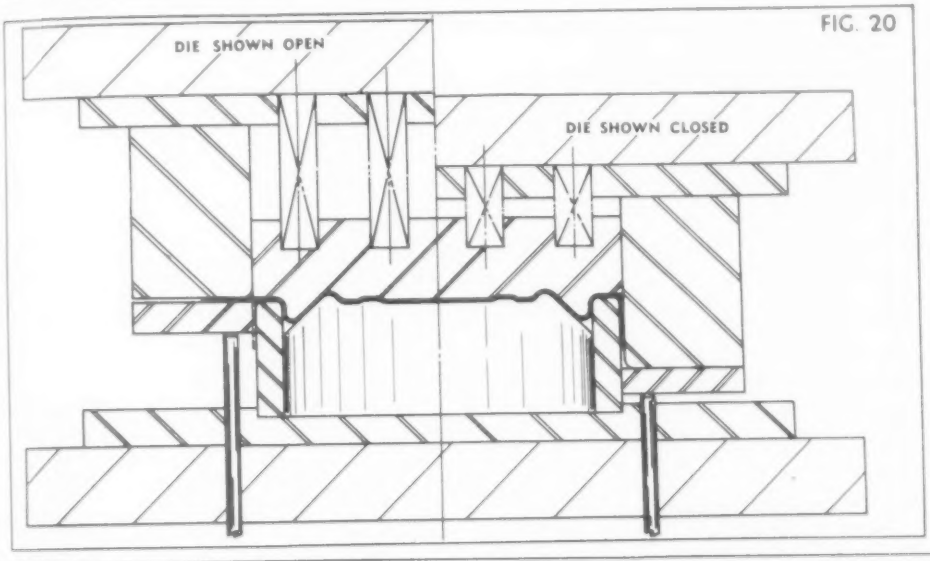


FIG. 20

Open Construction

Fig. 23 illustrates another die making use of open construction. The material requires more blank holding pressure when using this construction; however, eliminating the contour of the die provides a marked economy.

Figs. 24 and 25 illustrate the tools that were used to complete the flanged cup with its bottom pierced out and the side walls sized. The first operation was performed in the die shown in Fig. 24. The material was fed to the die in strip form and the operations blank, hold, draw and pierce were accomplished with each stroke of the press. The final operation sized the side walls as shown in Fig. 25.

Figs. 19 and 20 (left) show an intricate drawing operation. The edges of the blank are confined within the faces of the draw and pressure rings, thus keeping the metal under control during the entire press cycle. Figs. 21 and 22 (below) show an unusual contour formed in three operations. As will be noted, the part is inverted in the final (third) operation. The die for the first operation is not shown.

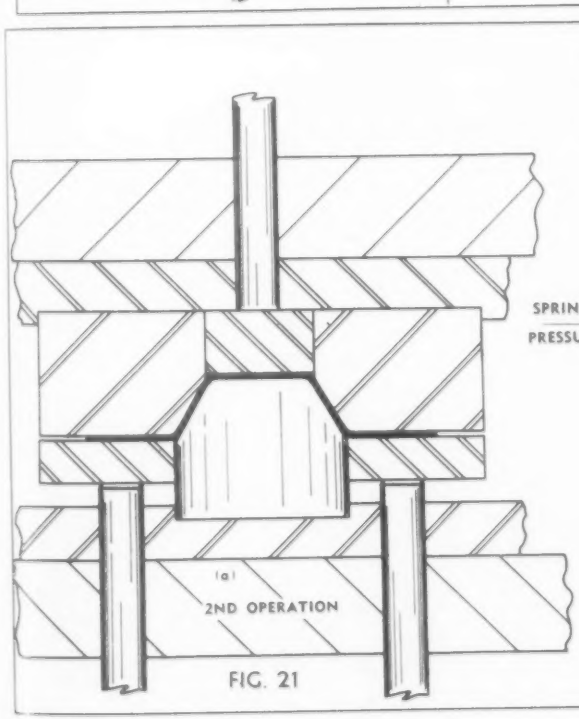


FIG. 21

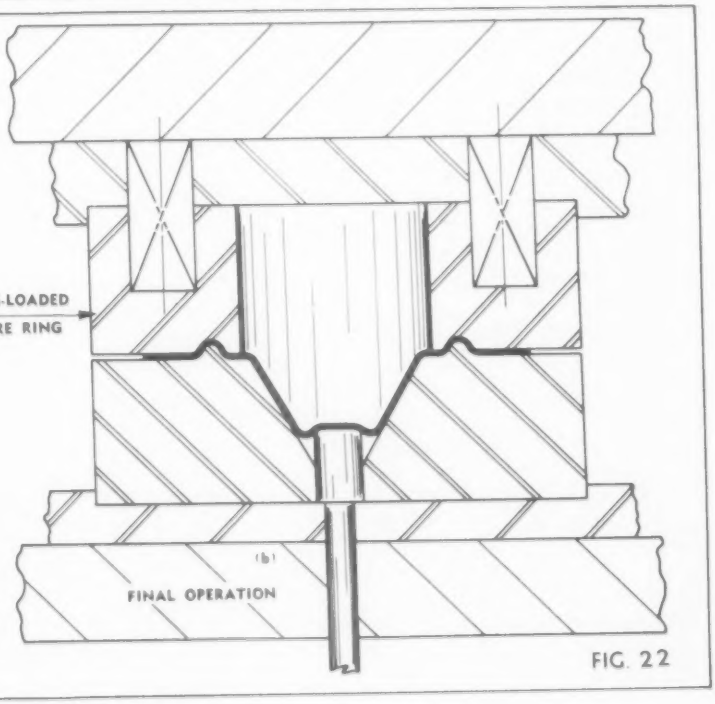
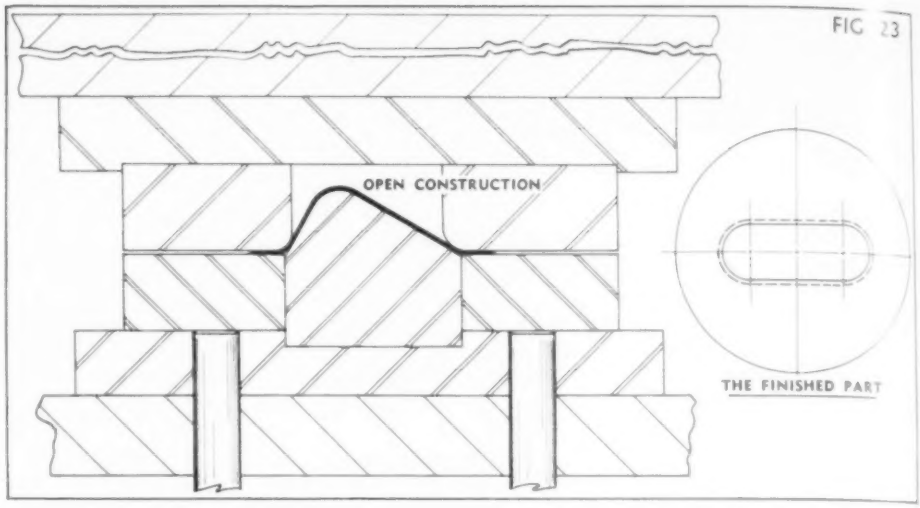


FIG. 22

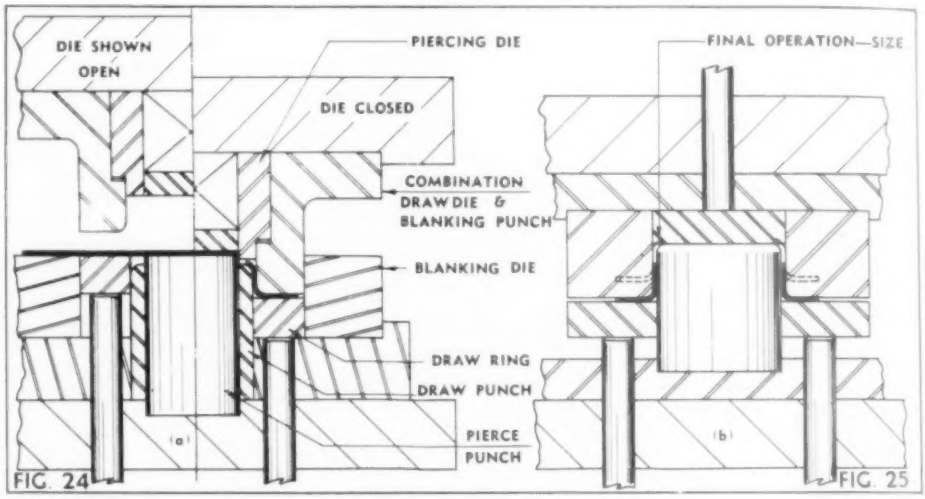
Fig. 23 shows an open construction die used to form the part shown at right. Figs. 24 and 25 show the dies used to complete the flanged cup, with bottom pierced out, shown in place in the die at right. The various stages of blanking, forming and piercing are indicated.



THIS CONCLUDES the Series on Drawing Die Problems and Formulae, by Mr. Walker. In view of the widespread interest in these articles, however, and also in view of requests for information relative to other phases of sheet metal forming coming into the editorial offices, another Series of articles on Deep Metal Drawing is now being processed for early publication in *The Tool Engineer*. The new Series will probably start in the May, 1948 number.

With regard to the articles by Mr. Walker, it is expected that these will eventually appear in book form; in the meanwhile, however, we will disburse tear sheets in the order in which they are requested, limiting one set to each applicant. When our supply is exhausted, photostatic copies may be had at cost.

The Editors



New Press for Powder Metals

Among the truly remarkable contributions to present day manufacturing economy is the fabrication of parts from powder metals, and especially so in the case of intricate parts that, ordinarily, would require multiple machining. For example, a hardened gear of about 1" diameter, 20 pitch, with an eccentric cam on one side, can be produced for about one cent as compared to other methods that would cost many times more. Thus, powder metal parts are effecting marked economies in the automotive industry, as many as 300 parts per car being used in some instances.

In line with this growing trend, Continental Machines, Inc., has developed a new press especially designed to effect the maximum economy in the fabrication of powder metal parts. This press is unusual in that pressures are applied from the top, bottom and sides, simultaneously, through use of hydraulic cylinders. Variations in pressure, for each cylinder, are also attainable through adjustment valves.

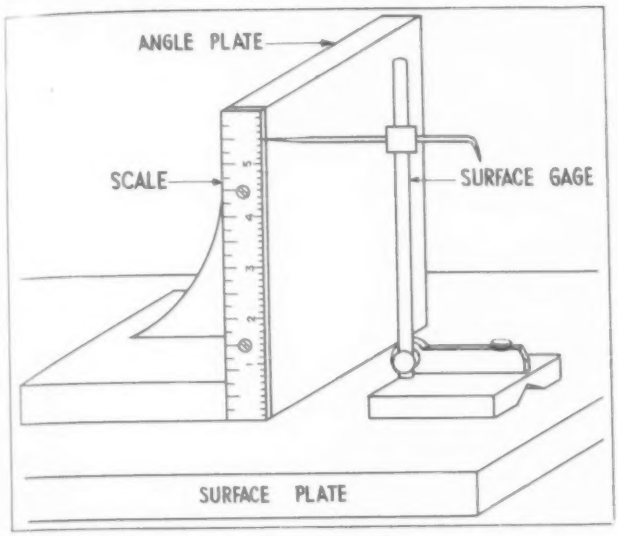
Each of the eight cylinder employed operate by separately driven Vickers pumps, exerting 2000 psi, the whole involving a unique cylinder setup and ram action that makes the press adaptable to a wide variety of shapes, either solid or cored. An advantage of this type of hydraulic drive is that each set of cylinders can be individually adjusted for rate of travel on both the power and return strokes, viz: 0 to 100 inches per minute on the power stroke and from 2 to 200 inches on the return stroke.

The press is provided with positive mechanical stops, for dimensional control, with relief valves providing control of density. The press is fully automatic, for high production runs, with potential output up to 150 parts per minute.

GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Graduated Angle Plate

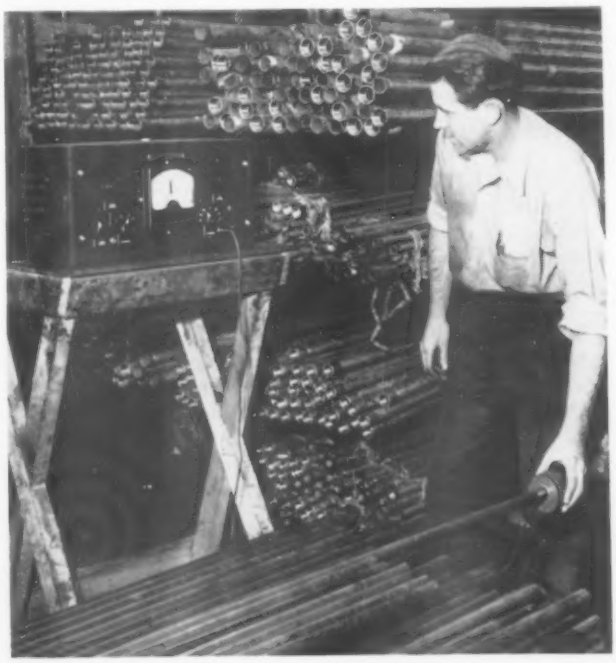


A 6" SCALE (or of length to suit) attached to the edge of one leg of an angle iron, as shown, will greatly expedite layout and setup work in the tool room or machine shop. The rule can be attached by brazing or silver soldering or, preferably, (as shown) with screws as the latter method of attachment prevents distortion and permits ready removal.

Edmund L. Johnson
Pittsburgh 6, Penna.

Metals Comparator

AN ELECTRONIC Metals Comparator, introduced by the Special Products Division of General Electric Company, provides a quick, non-destructive comparison of either magnetic or non-magnetic parts with a standard, differentiates between annealed and unannealed steel bars, and also sorts finished metal parts having different compositions or heat treatments.



The comparator incorporates a balancing network and indicating instrument, mounted in a steel cabinet, to which is connected an external test coil. A reference specimen is placed in the coil; then, after an initial balance has been established, parts to be tested are inserted briefly in the coil which quickly accepts or rejects according to desired limits of tolerance.

Formulas for Rope

COMPARATIVELY FEW USERS of rope and steel cable know the relationship between size of rope and its strength. They know that a large rope is stronger than a small one, and that's about all. Therefore, the following simple rules should be welcomed by rope users.

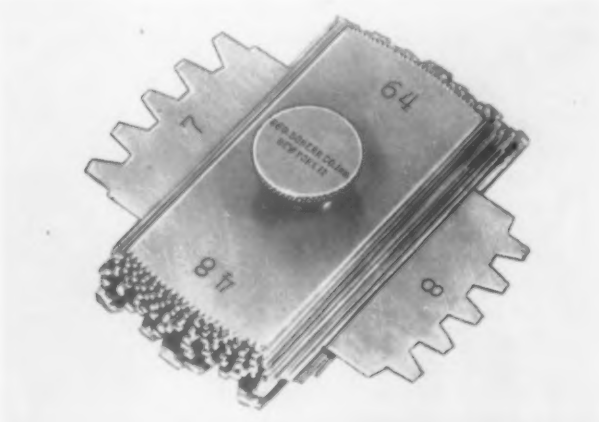
For cotton or hemp rope square the diameter of the rope in inches and multiply the product by 200. Thus, for a ½" rope, we have ½ x ½ x 200 or 50 pounds, which is the safe strength. For steel cable, square the diameter of the cable in inches and multiply by 12,000. Thus, for a ½" cable we have ½ x ½ x 12,000 or 3,000 pounds, which is the safe strength. Do not apply this latter rule to iron rope, which is not as strong as steel rope or cable.

W. F. Schaphorst, M.E., Newark, N. J.

Gear Gage Paper Weight

A PRACTICAL, useful novelty—a Gear Gage Paper Weight—which should be welcomed by gear manufacturers and users, engineers and estimators, combines the functions of an attractive paper weight and a set of gear gages. Made of highly polished stainless steel, the set is composed of 12 leaves which include 24 different gear shapes ranging from 3 to 64 diametral pitch.

The gear teeth, of correct involute shape, are machined by the Fellows gear shaper generating method, and segment blanks for each pitch are turned to conform to true tooth-diameter ratios. In other words, each is a true gear gage. Complete information, relative to these gear gages, may be had from the George Scherr Company, 200 Lafayette St., New York 12, N. Y.



by Karl Stad

Brown & Sharpe Introduces New Automatic

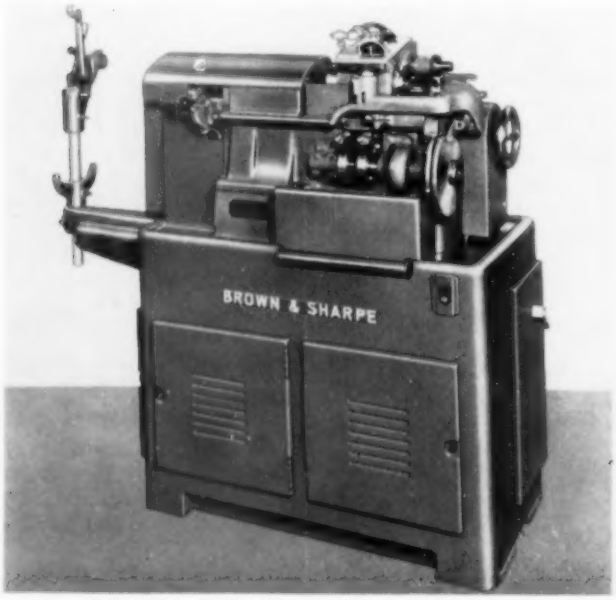
Pinion turning machine introduces marked simplicity of setup duplication.

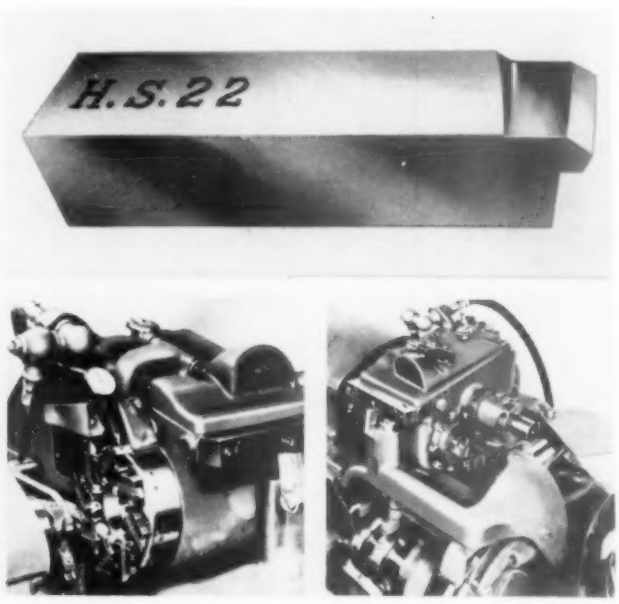
A TYPICAL EXAMPLE of current advances in design is the new Automatic Pinion Turning Machine, recently introduced by the Brown & Sharpe Manufacturing Company, Providence, R.I. With this machine, consistent accuracy in staff and pinion turning is made practically automatic, the while it introduces new and marked simplicity of setup duplication.

A marked feature is the practical elimination of inherent mechanical sources of inaccuracy. Only two cams are employed in the drive mechanism, and these are mounted close together, on the same drive shaft, to avoid torque distortion. Accuracy is further enhanced by a 4 : 1 ratio of cam lobe rise to longitudinal feed.

Single-point, circular-formed tools, an exclusive B & S development, together with accurate duplication of setups by means of dial indicators and individual micrometer stops, permits of sustained accurate operation without resort to highly skilled operators. Furthermore, uniformly automatic movements are insured, regardless of time required to make a part, by constant speed drive shaft. The machine, which takes stock up to ¼" diameter and turns up to 2-7/8" in length, has 16 spindle speeds from 910 to 10,000 RPM and the change gears providing rates of production from 3 to 364 seconds for one piece per cycle. Drive is by means of a 2 HP motor mounted inside of the base.

At left, the new Brown & Sharpe Automatic Pinion Turning Machine. At upper right, a typical B & S circular-formed single-point tool. Small photos show adjusting dial indicator on swing-arm, which permits accurate replacing of tool, and the individual micrometer stops, used for accurate setting.





Tool Show Preview

THE MARCH NUMBER of *The Tool Engineer*, which will be in the mails well ahead of the opening of The Tool Engineers Industrial Exposition, will contain a comprehensive Preview of the many exhibits which will feature this outstanding exposition. This Preview will show typical machines, small tools, appliances and accessories, and will be in addition to the features appearing in the ASTE News section.

At time of writing, there is every indication that the coming Exposition will surpass, both in the number and variety of displays and in attendance, any Show of its kind held in the United States. A keen interest is evinced abroad, and key executives from leading industrial centers in Europe and the Latin countries will be very much in evidence among the many thousands of tool engineers who will convene in Cleveland March 15 through 19. In view of the importance of tools to present-day manufacturing economy, attendance at this Exposition is practically a "must" for the industrial executive who wishes to keep abreast of current developments.

Index of Articles Starts

STARTING WITH this number of *The Tool Engineer*, and continuing until all articles, with authors, have been listed, is a cumulative index. The Index this month covers all articles published in Vol. XIX, Nos. 1 to 6—i.e., from July 1947 to January 1948. Previous Volumes will be indexed in reverse order—that is, Volumes XVIII back to XIV, No. 8, at which time the Society took over its official publication.

The index of articles will appear in two parts: under the author's name, with title of article, and also under the class of tools, products or techniques treated. In addition, the Tools of Today, together with short features, will be listed with the name of the manufacturer enclosed in parentheses.

This Index is being compiled in response to an insistent reader demand, both in the U.S.A. and abroad, and for that reason it is suggested that all who may want copies make application for same as soon as possible. It is the intention, however, to so locate the Index in the magazine that it may be readily cut out and filed.

THE TOOL ENGINEER

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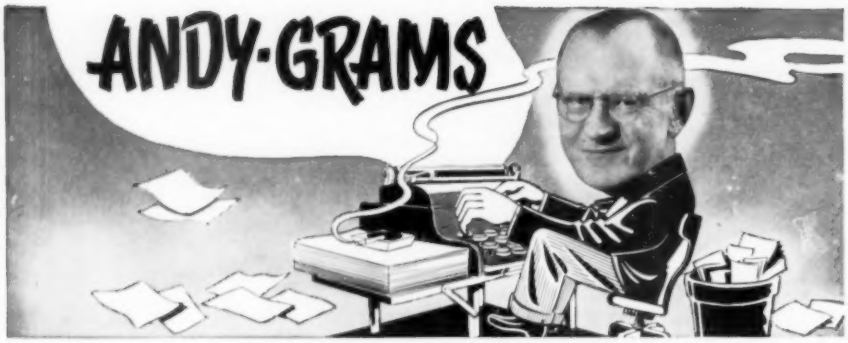


Well, here I am, just back from a trip to Rockford (Sweden, I came near saying) and adjacent territory that included the Fox River Valley. Quite a tour!—or, I should say, a series of tours that took in as many plants as I could visit in the time at my disposal. And now I'm home, with Tailwagger curled at my feet and my silent (?) partner busy with her knitting while I play a rhapsody on the portable. A great life!

In Elgin, which is where the Fox River Valley tool engineers met, the boys dined me at the Milkpail, an A-1 eatery that, I understand, is on Dunc Hines favored list. Mine too! Was driven out by Fred Lindblad, an up 'n' coming young fellow who, having invented a novel type of resinoid bonded grinding wheel, organized the U. S. Diamond Wheel Company, located in Aurora. He's doing right well.

Also, renewed acquaintance with Roy Frogness, whom I mentioned some time ago a/c the engineering service he organized a few years back. Now, Roy is setting his sights toward broader horizons, having in immediate view Texas and South America, where he intends setting up branch offices. Good going, Roy!

Through the good graces of Roger Waindle of the Sapphire Products Div'n, I was privileged to go through the plant of the Elgin National Watch Company. There, toured by a young engineer—Earl Schaefer by name—who, I predict, will go a long way with the company, I saw precision watches turned out by tools that, in many instances designed several decades ago, are still modern to all practical purposes. Beautiful workmanship!

Later, with Roger Waindle and George Ensign—who heads the lab—we lunched in the executives' dining room, where I had a whole carafe of coffee all to myself. Happy days! Roger then took me over to the Elgin Time Observatory, where Nat Warner initiated me into the workings of solar and sidereal time of which I'd heard a lot. Very interesting.

From Roger—who, incidentally, is an enthusiastic ASTE booster—I learned that the Sapphire Products Div'n is making considerable headway with precision bearings and synthetic sapphire cutting tools. Well, you creep before you walk, and then after a while you run.

Then to Rockford, toward which I've been starting on and off during the past thirty years or so but never got there until now. A nice, friendly town. First off, I visited the W. F. and John Barnes plant, where our V. Prex George Johnson holds down the Old Man's chair—i.e., when he sits. George showed me a line of equipment in process that'll go a long way toward keeping the inflation spiral within bounds. At least, it gave me more confidence in my next car.

From there to Barber-Colman, where Howard Nelson took me under his wing and, with justifiable pride, pointed out the various steps in manufacturing precision hobbing machines. Later, he turned me over to John Pike, who has charge of the B-C Textile Div'n. There, among other things, they're turning out gadgets that tie a thousand knots in thread quicker'n Bertha the Poor Sewing Machine Gal could knot one by hand. Takes A-1 mechanics to make gadgets like that.

Next, to the Rockford Screw Products Company, where screws of every description whiz out of the machines like bullets from a tommy gun. Mainspring of the outfit is Swan Hillman, a production wizard who came over from Sweden a few decades ago and, starting with an idea and a lot of faith, built up one of Rockford's leading industries. Free enterprise, if you please!

Just to show you what kind of a guy he is, it seems that they needed more room in one of the local hospitals, so, Swan mails out 1000 letters and sticks a crisp $1 bill in each. "Match that, or better," the letters said in effect, and with barely ⅔ returns in at the time of my visit, the total was around $18,000!

At the meeting, Jan. 8, found myself at the head table with George Johnson, Ch'man Ernest Seborg and the past Ch'men all but Ed Dickett who had a toothache same as I did only Ed was lucky having his pulling behind him, whereas I've got my "sitting" in prospect. But, let's talk about something else.

Also, as guest at the head table was Nils Testor, whose *Testor's Cement* has done a lot to hold this country together. Swell guy! And, out in front, Bill Moreland, late of Detroit and Chrysler Corp'n but now in Rockford with Greenlee Bros. Well, Greenlee's getting a good man and I imagine Bill will do right well in his new job. Congratulations to both.

Just before the meeting, met Fred Kessenich, who'd driven all the way down from Madison to invite me up there in March. But, I'll have to forego the pleasure, accepting a bid from Fond du Lac instead a/c conflicting dates.

Of course, it's nice of the boys to invite me around to say a few words and from now on I think that's what I'll stick to—a few words. Much as I'd like to emulate a Demosthenes or a Stentor, I just wasn't cut out for an orator. I'm too soft hearted, for one thing, and the minute I see a guy pull out his watch I get all contrite and wind up pronto. But then, getting around provides meat for the Column—and oh boy, the things I see!

Next morning, my dogs still willing, I took in the Sundstrand Pump Div'n, where I saw the latest of Sundstrand machine tools cutting costs on the home front. Ed Dickett and Mrs. then took me for a spin around town and to their home, all reminiscent of a New England manor. You know, small towns are okay. I like 'em.

Writing this in January, with the holidays just over, I want to take this opportunity to thank the many members and readers North, East, West, South who sent me Christmas cards. I wanted to acknowledge all personally, but just haven't been able to get around to it. This is just to let you know that I'm not forgetting the many friendly greetings. And the same to you and many of 'em. As the Swedes say: "God fortsättning," which, broadly translated, means good continuation.

While up in Rockford, I got a glimmer of the list of nominees for the Directorate, and got the impression that, no matter who is elected, we're bound to get 9 good men and true out of the list. Now, now, don't get excited!—I'm not going to put in a plug for any of 'em although, as for that, no one'd pay any attention to what I'd have to say anyway. All I want to say is that this is a democratic Society and it's up to the members to vote.

I was going to mention [redacted] a/c something he'd done in a big way, but the guy is on the list so I'll censor the name. Use your imagination. Some other time. Since, however, Brad Peirce is automatically a Director by virtue of being incumbent Prex, I'd like to say that he has been doing a swell job in shaping Society thinking. *God fortsättning*, Brad.

Well, the sand is running out of the glass, so—omygosh! I just happened to think I mentioned George Johnson up ahead, and as he's a candidate I'll go right back and censor out what I said about him. But I guess it's okay if I let him stay in as the Old Man at Barnes, eh? Anyway, I've no room for more—here's the final.

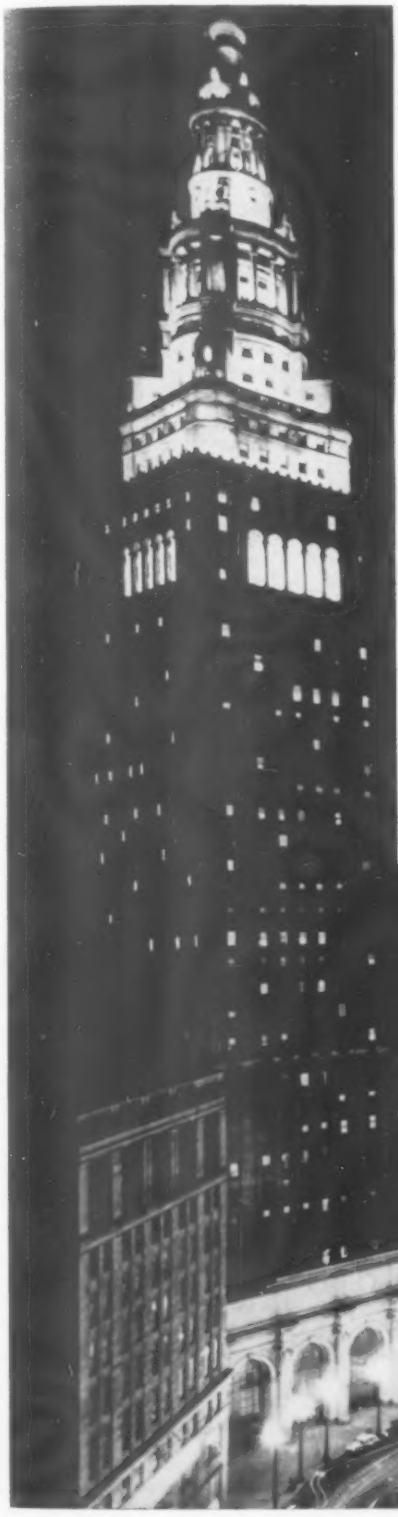
ASTEely Yours

Andy

A.S.T.E. Lights Pathway for Industry

Stabbing the night sky in an obelisk of light, Cleveland's Terminal Tower dominates the Public Square. Adjoining Hotel Cleveland will be scene of technical sessions and business meetings at ASTE convention next month

Cleveland Show Points Way to Greater Production Lectures and Plant Tours Aimed at Reducing Costs



WITH A FIVE-DAY major industrial show occupying 104,000 square feet, 33 plant tours, three technical sessions, a banquet to be addressed by a prominent industrialist, and a number of business meetings, all scheduled for the ASTE Tool Engineer's Industrial Exposition and 16th Annual Meeting, March 15-19, Society members and guests will have a busy and profitable week attending the national assembly at Cleveland.

Displays being prepared by exhibitors will include premieres of many new tools and machines, current refinements in some shown at recent trade shows, and radically new applications of well-known standard equipment.

Actual work demonstrations to be staged in many of the booths will give visitors an opportunity to compare the merits of competitive products and methods. All exhibits will be keyed around the tool engineer's problems in increasing production, improving quality, and lowering costs in the manufacture of goods so urgently needed at home and abroad.

Further applications of some of this equipment may be examined in a series of tours of local plants, most of which will be repeated several times so that a maximum number of show visitors may view the operations which interest them most. Both schedule and description of these inspection tours appear on other pages of this section.

Registration for plant tours and the Exposition will be at the Public Auditorium, scene of the big show. Plant tour tickets will be issued, eliminating delays incurred by registering at the plants. At the Aircraft Engine Research Laboratory of the National Advisory Committee for Aeronautics, visitors will be restricted to citizens of the United States, identified by birth certificate or citizenship papers.

The technical program, to be presented in the evening after Exposition hours, will open Monday at 8:00 P.M. with an address on "Work Handling Simplification" by Allan H. Mogenson, Director, Work Simplification Conference, Lake Placid, N. Y.; and Consulting Editor of *Factory*.

With a distinguished background of motion economy and work simplification, in industrial, educational, and publishing circles, Mr. Mogensen is in position to make valuable recommendations concerning handling costs, an item which bulks high in the total expenditure for manufacturing labor.

Gerald A. Rogers, Sales Engineer for Rudel Machinery Co., Montreal, Canada, is chairman of the session.

"Dies—Control of Deep Draws and Irregular Shapes" will be discussed Tuesday evening by N. E. Rothenthaler, Superintendent of Production and Plan-

ning, Steel Operations, Rolling Mill Div., Ford Motor Co., Dearborn, Mich. Presiding at this meeting will be Arthur D. Lewis, President, Art Lewis Production Equipment Co., Glendale, Calif.

Recent developments in metallurgical control of deep drawn stampings from cold rolled steel will be described by Mr. Rothenthaler, who is considered an authority on sheet metal work. Of particular interest will be his explanation of the procedure for developing body designs and dies for forthcoming Ford models.

An innovation in ASTE national programs, "The Tool Engineers' Quiz" will constitute the third and final technical assembly, Wednesday evening.

Robert W. Ford, ASTE National Program Chairman, and Field Engineer for Ex-Cell-O Corp. of Detroit, will be moderator for this forum when the 25 best technical questions submitted by the membership are answered by a board of experts.

All well-known in industry, the men composing this panel are: Alexander H. d'Arcambal, Vice-President—Consulting Metallurgist, Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford, Conn.; James K. Fulks, Vice-President in Charge of Manufacturing, Ex-Cell-O Corp.

Emil Gairing, President, Gairing Tool Co., Detroit; George H. Sanborn, Chief Field Engineer, The Fellows Gear Shaper Co., Springfield, Vt.; William H. Oldacre, President and General Manager, D. A. Stuart Oil Co., Ltd., Chicago, Ill.; Mr. Mogensen and Mr. Rothenthaler.

A copy of the forthcoming "Tool Engineers' Handbook" and a certificate of appreciation will be awarded to each member proposing a problem accepted for solution. Deadline for submitting questions is March 1. Details and a coupon for listing technical posers appear on Page 51 of the January issue.

Other questions may be presented from the floor if time permits. All of the technical meetings will take place in the Ballroom of Hotel Cleveland.

Highlight of the Annual Dinner and National Membership Meeting, Thursday evening at the Carter Hotel, will be an address by James D. Mooney, President and Chairman of the Board, Willys Overland Motors, Inc., Toledo, Ohio.

A graduate mechanical engineer from Cleveland's Case School of Applied Science, Mr. Mooney has a varied and practical experience in industry, is a veteran of both World Wars. A member of several national engineering societies, he will have an inspirational message for his ASTE audience.

* * *

Among other events on the banquet program are the installation of 1948-49 National Officers and of Cleveland Chapter Officers, and the award of the National Membership Trophy to the Chapter having the best membership record for 1947.

Directors for the coming year will be elected Thursday in a closed session of the House of Delegates, and the present Board will elect new National Officers during their meeting Wednesday and Thursday. Committee meetings are to be announced as they are scheduled.

Former chief executives of the organization will be honored at a Past Presidents' luncheon in Hotel Statler, Tuesday noon.

A registration fee of $1.00 entitles members and other industrial visitors to attend the Exposition and plant tours. Technical sessions are a complimentary educational feature, and tickets will be sold for the banquet.

Exposition hours will be from 9:00 A.M. to 6:00 P.M., Monday to Friday inclusive.

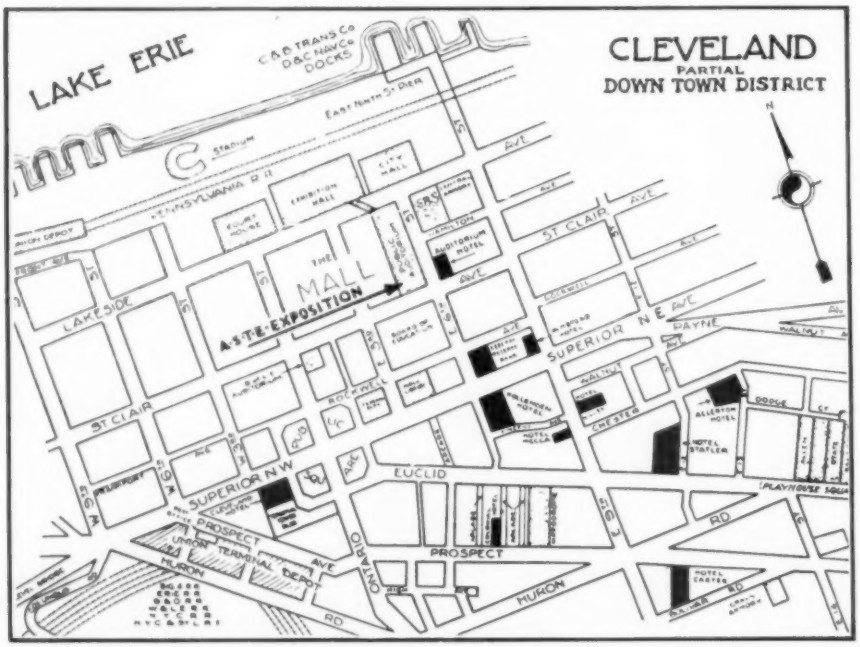
* * *

Badge registration forms and room and banquet reservation blanks have been issued to all members of the Society and should be returned promptly as instructed.

Registration will be handled in the Public Auditorium Foyer by members of the Central Office force at Detroit.

A housing office will be maintained at the Public Auditorium; and Cleveland Chapter members and representatives of the local Convention Bureau will man ASTE information desks in the lobbies of Hotels Statler and Cleveland.

Among carriers cooperating in arranging transportation to Cleveland, American Airlines has volunteered the services of its 65 offices, whose staffs have been briefed concerning the convention schedule.



Layout of Downtown Cleveland shows proximity of Public Auditorium to hotels and transportation terminals. Arrows in photograph point to the Auditorium and the Lakeside Exhibition Hall connected by an underground passage, needed to house the immense ASTE Exposition

J. D. Mooney

A. H. Mogensen

N. E. Rothenthaler

W. H. Oldacre

Emil Gairing

J. K. Fulks

A. H. d'Arcambal

A.S.T.E. 16th ANNUAL MEETING

AND

TOOL ENGINEER'S INDUSTRIAL EXPOSITION

Hotel Cleveland, Carter Hotel, Cleveland Public Auditorium

CLEVELAND, OHIO • MARCH 15-16-17-18-19

G. H. Sanborn

Monday, March 15, 9:00 A. M.

Tool Engineer's Industrial Exposition Opens,** ***Public Auditorium

1:00 P. M. Plant Tours—Fisher Body Div., General Motors Corp.; The Ohio Crankshaft Co., The Warner & Swasey Co., The White Motor Co.

6:00 P. M. *Tool Engineer's Industrial Exposition Closes

8:00 P. M. Technical Session, ***Ballroom, Hotel Cleveland***
Chm., G. A. Rogers, Sales Eng., Rudel Machinery Co., Montreal

"Work Handling Simplification"
A. H. Mogensen, Director, Work Simplification Conference, Lake Placid, N. Y.; Consulting Editor, *Factory*

• • •

Tuesday, March 16, 9:00 A. M.

Plant Tours—The National Acme Co., Nela Park—General Electric Lighting Institute, The Reliance Electric & Engineering Co., The Weatherhead Co., The White Motor Co.

Noon Past Presidents Luncheon, ***Hotel Statler***

1:00 P. M. Plant Tours—Fisher Body Div., General Motors Corp.; The Ohio Crankshaft Co., Republic Steel Corp., The Warner & Swasey Co.

8:00 P. M. Technical Session, ***Ballroom, Hotel Cleveland***
Chm., A. D. Lewis, President, Art Lewis Production Equipment Co., Glendale, Calif.
"Dies—Control of Deep Draws and Irregular Shapes"
N. E. Rothenthaler, Supt. of Production and Planning, Steel Operations, Rolling Mill Div., Ford Motor Co., Dearborn, Mich.

• • •

Wednesday, March 17, 9:00 A. M.

Plant Tours—The National Acme Co., Nela Park—General Electric Lighting Institute, The Weatherhead Co.
Annual Meeting, Board of Directors, ***Hotel Cleveland***

1:00 P. M. Plant Tours—Fisher Body Div., General Motors Corp., Jack & Heintz Precision Industries, Inc., The Ohio Crankshaft Co., The Warner & Swasey Co., The White Motor Co.

*Same hour each day.

8:00 P. M. "Tool Engineers' Quiz." ***Ballroom, Hotel Cleveland***
Moderator, R. W. Ford, Field Eng., Ex-Cell-O Corp., Detroit, Mich.

Board of Experts

A. H. d'Arcambal, V.-Pres.—Consulting Metallurgist, Pratt & Whitney, Div. Niles-Bement-Pond Co., W. Hartford, Conn.; **J. K. Fulks,** V.-Pres. in charge of Mfg., Ex-Cell-O Corp., Detroit, Mich.; **Emil Gairing,** Pres., Gairing Tool Co., Detroit, Mich.; **G. H. Sanborn,** Chief Field Eng., The Fellows Gear Shaper Co., Springfield, Vt.
A. H. Mogensen, Director, Work Simplification Conference, Lake Placid, N. Y.; Consulting Editor, *Factory*; **W. H. Oldacre,** Pres. and Gen. Mgr., D. A. Stuart Oil Co., Ltd., Chicago, Ill.; **N. E. Rothenthaler,** Supt. of Production and Planning, Steel Operations, Rolling Mill Div., Ford Motor Co., Dearborn, Mich.

• • •

Thursday, March 18, 9:00 A. M.

Plant Tours—Jack & Heintz Precision Industries, Inc., The National Acme Co., Nela Park—General Electric Lighting Institute, The Reliance Electric & Engineering Co., The Weatherhead Co., The White Motor Co.

House of Delegates Meeting, ***Hotel Cleveland***

Board of Directors Meeting, ***Hotel Cleveland***

1:00 P. M. Plant Tours—Fisher Body Div., General Motors Corp., Aircraft Engine Research Laboratory—National Advisory Committee for Aeronautics, Cleveland Airport; The Ohio Crankshaft Co., The Warner & Swasey Co.

7:00 P. M. Annual Dinner and National Membership Meeting, ***Ballroom, Carter Hotel***

Speaker: J. D. Mooney, Pres. and Chm. of Board, Willys-Overland Motors, Inc., Toledo, Ohio
Installation of National Officers and Cleveland Chapter Officers
Award of National Membership Trophy

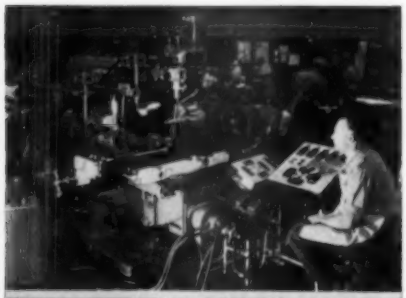
• • •

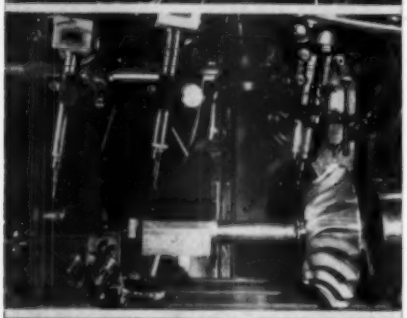
Friday, March 19, 9:00 A. M.

Plant Tours—Nela Park—General Electric Lighting Institute, The Weatherhead Co. (Tentative)—The Ohio Crankshaft Co., The Warner & Swasey Co.

6:00 P. M. Tool Engineer's Industrial Exposition Ends

STEEL···Lifeblood of Cleveland Industry





Metalworking, from Rolling Mill to Assembly Line, To Be Demonstrated in Guided Tours of Host Plants

MANUFACTURING, RANGING all the way from production of strip steel, through the building of machine tools, electric motors, automotive, aircraft and refrigeration parts, to complete automotive vehicles, will be available for inspection by visitors to the Tool Engineer's Industrial Exposition.

During the show week, March 15-19, 11 Cleveland organizations including two research centers, will open their doors to the Society in a series of 33 plant tours.

Properly identified United States citizens will be admitted to the Flight Propulsion Research Laboratory of the National Advisory Committee for Aeronautics at Cleveland Airport. Newest of the three NACA research centers, this aircraft engine experimental station is continually improving its facilities to study newer types of engines to propel airplanes at supersonic speeds.

The tour will begin in the Engine Research Building, through the friction and wear, stress and vibrations, and high temperature materials laboratories, and the overhaul section.

Atmospheric Conditions Simulated

Engine performance is tested under flight conditions in the Altitude Wind Tunnel. Only a few feet from the world's largest low-temperature refrigeration plant, engineers in a comfortable test room read by their instruments the story of an engine's reaction to sub-zero hurricane conditions.

The aeronautics laboratory has its own machine shops to make otherwise unobtainable engine parts, and metallurgical and heat treating laboratories where new high temperature resistant materials for gas turbines are constantly sought. Inspection of the hangar, capable of accommodating planes with rudders over 40 feet high, will complete the tour.

At Nela Park, home of the "University of Light," General Electric Co. conducts its Lighting Institute. Here full scale lighting applications for commerce, industry, schools, and homes are tested and demonstrated in attractive displays with eye-popping scientific gadgets.

The program planned for the ASTE visit will be especially geared to tool engineers' interests, with exhibits, talks and illustrations slanted to their field.

Slab to Strip in Four Minutes

The spectacle of glowing steel slabs, speeding through 98-inch hot strip mills to a strip coiler almost a quarter of a mile away in as little as 240 seconds, will be presented at Republic Steel Corp. As a cold slab is fed into the heating furnace, a hot one is pushed out on the opposite side, then reduced in the roughing scalebreaker. The broken scale is removed by water under the terrific pressure of 1200 pounds psi.

Next is the broadside mill where slabs may be turned broadside for spreading to greater width, then the squeezer which trues up the edges and further flattens the slab before it runs through the roughing rolls.

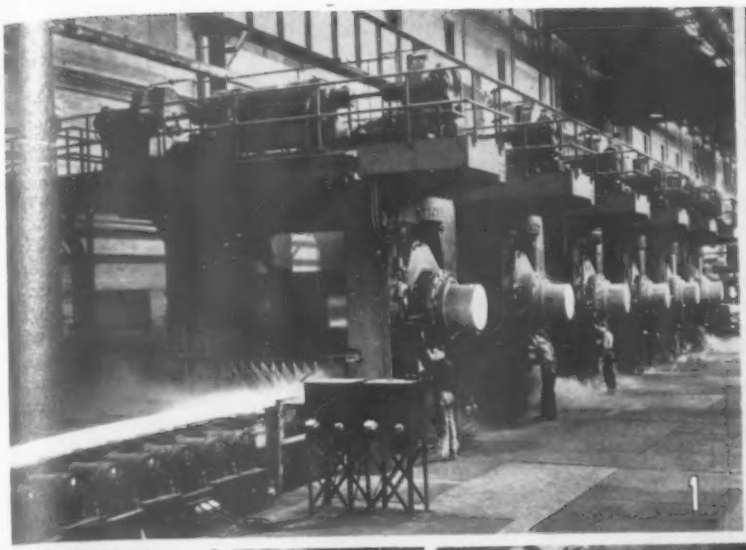
From here it passes to a 142-foot delay table where the temperature is carefully watched until the steel has cooled enough to enter the finishing scalebreaker. After rolling through six more finishing stands, it reaches the desired thickness and is sprayed with water on a 613-foot run-out table. The strip steel is then cut into sheets for use, or coiled and treated for cold rolling.

An interesting feature is the battery of 4500 hp. motors which drive the hot mills at speeds synchronized to compensate for the increasing length and thinness of the strip.

How a high frequency electrical process of heat treating, originally developed as an improved and less costly method of surface hardening crankshafts, became an important contribution to the metal

Left, from top: 1. Duplicating in four dimensions to produce the curved passages of a supercharger impeller at the Aircraft Engine Research Laboratory of the National Advisory Committee for Aeronautics. 2. Closeup of three dimensional duplication for fabricating an experimental supercharger impeller in the machine shops of the NACA laboratory at Cleveland. 3. Perfect alignment in boring the head for the rear spindle bearing of a Warner & Swasey turret lathe is assured by a specially developed optical method resulting from experience in the designing and building of telescopes. 4. This lathe equipped with strain gages, an oscillograph and sensitive instruments, and driven at speeds up to 5000 rpm by a direct-coupled 100 hp motor, is used for experiments in the company's long range research program in carbide tooling. 5. Lighting problems for home, school, business and industry are solved in the Engineering Building at Nela Park, General Electric Co.'s lamp research division. 6. This exhibit, seen in the tour of the "University of Light," is representative of some 10,000 types of lamps

Right: 1. Steel slabs being reduced to sheet whirl at breathtaking speed through this six-stand finishing train of the hot mill at Republic Steel Corp.'s 98" continuous strip mill in Cleveland. 2. Reliance Electric & Engineering Co. employs one of its own V-S drives on its largest Minster stamping press, to provide adjustable speeds suiting a variety of materials and operating conditions. 3. Here a 600-ton Elmes hydraulic press just installed by Reliance, increases manufacturing flexibility through use of economical, formed metal parts. 4. Chronologs, "automatic secretaries" which analyze machine idleness, and report production count every 10 minutes, are inspected at The National Acme Co. 5. A N.A. worker machines motor starter housings in 10 seconds on an Acme-Gridley 12" Chuck-Matic. 6. Cups for automatic milking machines are silver soldered by a 15 kw, 10,000 cycle Tocco machine. 7. In another installation, for forging tractor track links, a billet is ejected from a Tocco induction heater every 10.7 seconds. Similar demonstrations will be made for Society visitors to the Tocco Research Laboratory. 8. With a single setup, Jack & Heintz simultaneously grind both ends of a rotor shaft in stock-feeder equipped Cincinnati centerless machines. 9. Rotor shafts for J & H electric motors are knurled on a Waterbury thread roller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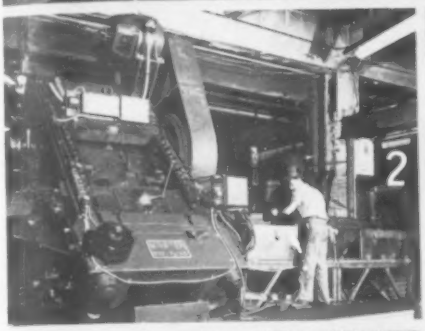
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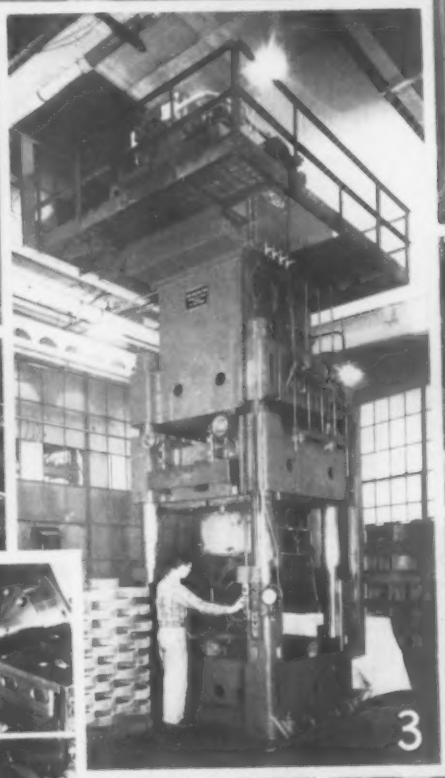
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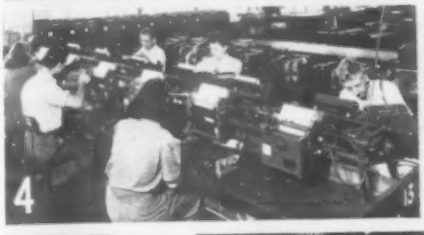
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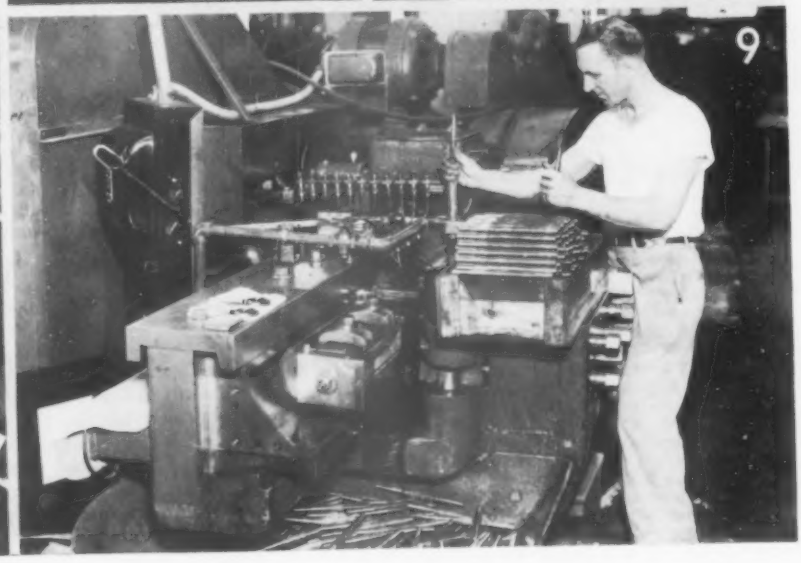
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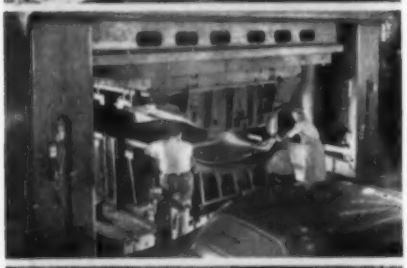

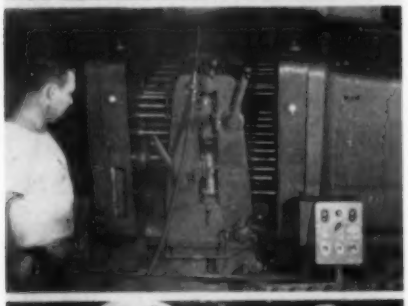

From top: 1. Station wagon bodies, an innovation in Fisher Body production, roll down the assembly line of the Cleveland plant. 2. This new, electronically controlled, streamlined type of press, with most of the working parts located in the press pit rather than on top, will eventually replace the huge giants that have turned out steel tops for Fisher bodies over the years. 3. Part of the battery of forging presses including two 500-ton Maxi and one 1000-ton Minster press, in which brass and aluminum forgings are fabricated at The Weatherhead Co. 4. A five-head Kingsbury machine, set up for fuse heads made during the war, now performs various drilling operations for production runs on Weatherhead parts. 5. White Motor Co. uses a Bausch multiple-spindle drilling and tapping machine on cylinder heads. 6. Gear cutting will highlight machining operations at the White plant where ASTE guests will see truck and bus manufacture

working industry, will impress those who visit the Tocco Induction Heating Research Laboratory of The Ohio Crankshaft Co.

Twenty-four induction heating stations with power frequencies of from 960 to 1,000,000 cycles are equipped to handle an extremely wide range of heating requirements.

A staff of engineers experiments on individual heating, hardening, annealing and brazing problems for industry, to determine the most effective applications of the induction process. Several setups will be demonstrated during the Society tour, which includes the crankshaft and camshaft plant.

Machining for Automotive Units

Truck and bus fabricating to be inspected at White Motor Co. will include cutting of gears for engines, transmissions and rear axles, machining and Magnaflux inspection of axles, machining of screws and engine parts, heat treating and plating, assembly of 12-cylinder, pancake engines for motor coaches, and truck engines.

Break-in and testing of engines will be shown in the dynamometer department. Gas tanks, running boards and floor boards for trucks are turned out by the sheet metal department. Other sections to be visited include the cab department, metallurgical laboratory, salvage and shipping departments, axle assembly, frame room, erection lines, steel yard and morgue, as well as the operator school.

Claimed to be the world's largest manufacturer of tube fittings and flexible hose assemblies, The Weatherhead Co. is planning a trip that will also give visitors opportunity to see large production runs of parts for the automotive, aircraft, refrigeration and liquefied petroleum gas industries.

Precision in Jet Instrument Parts

Diversified fabrication, automatic screw machine operation, laboratory procedure and special testing equipment, induction and electrical brazing, and straight line production will be among operations to be shown in the 14½ acre plant producing more than a million parts a day.

An outstanding maker of instruments and parts for jet propelled planes, the company will show many of the precision measuring devices which they have developed, and close tolerance machining operations.

At Warner & Swasey Co., "precision" has been the watchword since the company's early days when it added the building of astronomical telescopes to its original lathe product.

Production now includes precision tapping and threading machines developed to meet the demands of the aircraft industry, automatic bar and chucking machines, radar antennae, textile machinery and earth movers. In this well-equipped plant, the engineers will see W & S turret lathes machining parts for other turret lathes, along with many other metal removing operations, testing, measuring, and foundry work, performed to exacting standards. Experiments in the company's long range program of [illegible] cutting tool research also may [illegible] observed.

Highlights of the tour through The National Acme Co. will include m[illegible]ple spindle bar and chucking automat[illegible] machines in actual production, emph[illegible]ing tools and attachments to eliminate [illegible]tra equipment and handling.

The contract manufacturing di[illegible]sion will show typical screw machine [illegible]era-tions, and specialized jobs done [illegible] a quantity basis, from raw stock to fin[illegible]hed product. The new Vers-o-tool with ground thread circular chasers, or hollow milling cutters adaptable to end-forming and extending the life of normal thread-ing equipment fifty times, will be seen in the threading department.

The electrical manufacturing division will demonstrate the Chronolog, a device attachable to any process subject to interruption to analyze equipment idleness. This section will also show the economy of snap lock limit switches and Stellite welded solenoids.

Press Mechanism in Pit

Essentially a stamping unit, the Cleveland plant of the Fisher Body Div., of General Motors Corp. has more than 300 presses, some weighing more than a million pounds. Among these are large, streamlined postwar presses with electronic controls and much of their mechanism in the press pit rather than on top. In these huge presses, body roofs are stamped out at a single blow.

Also of interest to the visiting engineers will be the metal assembly sections of the plant. Doors and similarly fabricated parts are stamped and then assembled here for shipment to automobile final assembly plants. Assembly of station wagon bodies will be another feature of the Fisher tour.

Electric motors of from ½ to 500 hp., motor generators, all-electric adjustable speed drives, electronic machine tool controls, and related accessories will be seen in production at The Reliance Electric & Engineering Co.

An interesting application of the Reliance V-S drive, to suit a variety of materials and operating conditions, may be studied on large Minster stamping presses at work in the plant. Other high points in the tour include the performance of new machinery installed for more economical production of parts, and the engineering laboratory for research on customers' motor application problems.

Trips Will Be Repeated

Jack & Heintz Precision Industries, Inc. will show how fractional hp. motors are made. Among other products to be seen in process of manufacture are refrigeration condensing units.

Too late for inclusion in the program page, an additional company tour has been announced as this issue goes to press. On Tuesday and Wednesday afternoons, the Willard Storage Battery Co. will show the visiting engineers how storage batteries are made and assembled.

Most of the tours will be repeated several times. A complete schedule of factory visits appears in the program listed on another page of ASTE News.

A.S.T.E. Sixteenth Annual Meeting Committees

NATIONAL PROGRAM COMMITTEE

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R. W. Ford

2nd V.-Chairman

F. J. Schmitt

Secretary

J. O. Horne

G. A. Rogers

A. A. Nichols

C. H. Peters

1st V.-Chairman Natl. Program Com.
General Chairman Host Chapter Committees

E. W. Baumgardner

H. E. Linsley

A. D. Lewis

HOST CHAPTER COMMITTEES

Vice-Chairman Chg. of Technical Program Host Chapter Coms.

H. B. Osborn, Jr.

Chairman Budgets Supplementary Activities

J. H. Schron

Chairman Physical Arrangements

A. B. Clark

Chairman Publicity

E. W. Harry

Chairman Banquet

R. M. Whitaker

Chairman Plant Tours

G. A. Hier

Chairman Transportation

R. C. Southwell

Chairman Reception

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Chairman Social Program

R. R. Rhodehamel

Chairman Entertainment

J. R. Fitzsimmons

Chairman Signs

C. W. Buxton

Chairman Emergency

H. E. Peiffer

Carbides, Metal Drawing Technical Co-Features

Rochester, N. Y.—One hundred and sixty-five members and guests of Rochester Chapter were present at the December meeting to hear A. E. Glen, Manager of Die Sales, Carboloy Co., Inc., whose subject was "Application of Carboloy in the Die Field," and J. J. Zimmerman, Chief Tool Engineer, Playboy Motor Car Corp., who spoke on "Deep, Medium and Shallow Drawing."

The first important use for carbides, Mr. Glen began, was in cutting tools, with the wire drawing field becoming the next large user. Today carbides are used in dies for drawing, blanking, laminations and cold heading dies. It is not unusual to hear of carbide lamination dies producing from 1,000,000 to 1,500,000 parts before resharpening.

One of the difficulties in building carbide dies was in holding the carbide sections. Mr. Glen illustrated a number of successful mechanical methods for holding these sections in place, one consisting of casting steel inserts into carbide sections to be later drilled and tapped.

In describing various types of sheet metal drawing, Mr. Zimmerman pointed out some common faults encountered and their remedy. He also discussed at some length pinch trimming and form cut trimming.

Both talks were amply supplemented by slides. At the conclusion of the lectures, the number of questions raised from the floor indicated lively interest in both subjects.

Instrument Manufacture Viewed in Plant Tour

Denver, Colo.—The local ASTE and ASM groups visited Hathaway Instrument Co. December 3. After being conducted through the plant, the guests were permitted to revisit any department and ask additional qustions.

Among products shown were electronic devices to measure the strain on anything from a heart beat to a bridge, instruments used in national defense, and others to completely analyze aircraft flight from the rpm of the engines to strains incurred in flying maneuvers.

One of the high points of the evening was the "pouring off" in the aluminum foundry, a department supervised by A. W. Hall, Second Vice-Chairman of the Chapter. Considerable interest was aroused when Mr. Hall showed the group aluminum castings considered impossible to make.

Refreshments were served at the plant.

Collins Moves to Coast

St. Louis, Mo.—William F. Collins is removing his consulting engineering office from St. Louis to Los Angeles, Calif.

For the past twenty years Mr. Collins has served metal working plants throughout the Mid-west, and was active in aiding the development of war production in St. Louis where he has been affiliated with the local ASTE Chapter.

Illustrates Versatility Of Induction Heating

Atlanta, Ga.—Dr. H. B. Osborn, Jr., Director of Research, Tocco Div., The Ohio Crankshaft Co., Cleveland, Ohio, was speaker at the December meeting of Atlanta Chapter. His address, "Induction Heating," was presented on the 15th in the Banquet Hall of Georgia Tech.

Dr. Osborn revealed how induction heating had overcome disadvantages of other types of surface heating, describing some of the early equipment used.

Three types, and the economics of each were discussed: (1) motor generation, (2) vacuum tube oscillation, and (3) spark gap converters. Formulas were given showing the relationship between frequency, time, work size, and power required to heat.

The lecture was amply illustrated with slides showing examples of induction heating, ranging from annealing of small cartridge cases to the hardening of bearing surfaces on huge Diesel engine crankshafts. Several interesting points in tooling for production hardening were emphasized, making apparent the simplicity of fixtures and work coils.

At noon of the same day, Dr. Osborn addressed the Georgia Engineering Society on "What's New in Industry," giving a brief outline of recent developments in machines, materials and processes.

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Plastic Coating Protect Tools in Shipping, Storage

Toledo, Ohio—After a 'round the world air cruise of nearly 20,000 miles, [illegible]% of 128 miscellaneous articles experimentally dipped in a plastic coating and packed in cardboard containers, arrived in excellent condition, I. L. Thompson, District Manager of Seal-Peel, Inc., Detroit, Mich., told Toledo Chapter members during a discussion of "Plastics in Industry" at their December meeting.

A protection against the ravages of salt water and other elements, the material was used extensively in preparing war materials for shipment overseas, during the latter part of the conflict, Mr. Thompson stated.

Lighter than other packing materials, it effects savings in transportation costs, he pointed out.

"Hot dip" as a protection for tool cutting edges and other fragile parts, during shipping and in storage, was explained in detail to the engineers.

Other products, applied with sprayer or brush, for fireproofing and waterproofing cloth, for preventing condensation on glass, and for removing paint, were described briefly.

A display of items protected with "hot dip," and a heating pot were shown.

Prior to the technical session, Past Chairman Samuel Burgess related highlights of a recent trip to England.

He compared products and working conditions in plants visited with those prevailing in the United States. He was most impressed by the low wages paid workers, the high income taxes, and the severity of food rationing.

Canadian Group Visits Machine and Tool Plant

Windsor, Ont.—Standard Machine & Tool Co., Ltd., of Windsor was host to Windsor Chapter members for their December meeting.

After a buffet dinner, Mr. Oliver, Chief Engineer for the company, showed slides of recently built machines for installation in Canadian plants. H. Chambers, President and General Manager, and R. Davidson, Vice-President and Treasurer, both spoke of contemplated company projects, stressing the importance of more domestic-built machines.

A film of a complete robot plant was presented by representatives of the W. F. & John Barnes Co. of Rockford, Ill.

Later the 160 members present made a tour of the Standard plant, observing with keen interest many of the newer types of drilling and boring machines.

600 Attend Yule Party

Detroit, Mich.—Approximately 600 members and guests of Detroit Chapter enjoyed a merry evening on the occasion of their annual Christmas party held December 11 at the Book-Cadillac Hotel.

A social hour preceded dinner served in the ballroom. Entertainment included five vaudeville acts by professional talent and an eight-piece orchestra which played throughout the evening.

Food-Shedding Necktie Dreamed Up By Science

St. Charles, Ill.—A necktie, chemically treated to shed food, is only one of many novelties now being created by science, Walter G. Greenebaum of Chicago, nationally known lecturer, told 125 members and guests of Fox River Valley Chapter during a ladies' night dinner program December 2 at the Baker Hotel.

Mr. Greenebaum predicted that, within a few years, plastic canopies will protect pedestrians from rain, sun and dust in most of the business streets of the nation. Sidewalks will be inlaid with pipes circulating hot water in winter and cool water in summer. In the next 40 years he foresees a life expectancy of 100 years for men and 105 for women.

The average man will be over six feet tall, while women will attain a mean height of five feet eight inches. Humanity will have longer feet, higher heels, no bald heads, fat, nor gray hair.

The phenomena would be achieved through group sanitation, shorter working hours, air conditioning and vitamined food. People concerned with the rising cost of living can take heart from the speaker's disclosure that grass has now been treated to create an appetizing, energizing and economical food for human beings.

Cornerless corners, wrinkle proof and water proof fabrics, unsinkable boats, asbestos dishtowels, grass salt, arm thermometers, edible egg shells, homes heated by sunlight, electricity and heat transmitted by beams rather than by wire, all were included in Mr. Greenebaum's seemingly inexhaustible repertoire of scientific developments.

For the business man, he described a typewriter which takes dictation and types the letter without human aid.

Roy Frogness, Chapter Chairman, presided and introduced the speaker. C. C. Moore of Aurora showed a sound and color film, "One Thousand Miles of the Inland Seas."

Between acts in the entertainment, the photographer catches this amiable crowd attending Cleveland Chapter's Christmas party. Proceeds of the affair will be used to establish a $500 engineering scholarship

Holland Guest Speaker At Christmas Festivities

New Haven, Conn.—Seventy members and guests gathered at New Haven Country Club December 12 for the annual Christmas party of New Haven Chapter.

Guest speaker was First Vice-President I. F. Holland of Hartford, Conn., who gave highlights of the Society's activities, including preparation of the Handbook, expected later this year.

A General Electric film, "Clear Waters," was shown under the direction of Mr. Dautrich.

Anthony "Tony" Levelli, accordionist and Yale basketball star, and Ruth Sprague, pianist, furnished musical entertainment. Community singing was enjoyed and gifts were distributed to the assembly.

Brady and Speickhoff Represent Kennametal

Latrobe, Pa.—Recently appointed to the sales staff of Kennametal, Inc., are Jerome G. Brady as tool engineer and representative working out of the Pittsburgh district office and Lester Speickhoff who will serve in a similar capacity in the Syracuse area.

Mr. Brady, a Greater New York Chapter member, was formerly Sales Engineer for Liggett Spring & Axle Co., Monongahela, Pa., while Mr. Speickhoff was Vice-President of Conversion Engineering Co., Syracuse, where he is affiliated with ASTE.

500 at Christmas Party

Cleveland, Ohio—Some 500 Cleveland Tool Engineers and their ladies attended the Chapter's Eighth Annual Christmas Party in the Allerton Hotel, December 6.

A social hour and dinner preceded a program of professional entertainment, and dancing concluded the festivities. The ladies received attractive favors.

Entertainment Chairman J. R. Fitzsimmons and his committee were in charge of the enjoyable affair. Proceeds will be used to establish a $500 engineering scholarship.

Powdered Metal Parts Are Self-Lubricating

Poughkeepsie, N. Y.—"Powder Metallurgy" was the subject presented by Douglas B. Martin, Sales Manager, Amplex Div. of Chrysler Corp., Detroit Mich., to 85 members and guests of Mid-Hudson Chapter at a meeting December 9 in the Nelson House.

The fabrication of porous metal, self-lubricating bearings, machine parts, metallic filters, electrical parts, clutch facings, and bar stock, all made from powdered metals, was explained by the speaker.

Common metals such as tin, lead, copper, aluminum and iron, in powder form, are compressed to one-third of their volume to produce the five forms of Oilite described.

Compressed Oilite, according to Mr. Martin, contains 25% of oil by volume and will retain its lubricating qualities on average applications for the life of the machine into which it is assembled. Certain types of the compressed metals are designed to withstand loads up to 100,000 lbs. psi and speeds up to 40,000 rpm.

Certain types may be selected for high resistance to friction and others for high load carrying, or anti-corrosive qualities. The material may be secured in molded-to-precision-form bushing, bar, plate, or sheet depending on the volume and application.

The talk, valuable to engineers responsible for design of product, tools or manufacturing processes and the setting up of material specifications, was illustrated with a film and slides and followed by a discussion period. A display of approximately 200 sample parts was shown.

Meredith Bloss, City Librarian, in a coffee talk, "Guide Posts in the World of Print," gave information concerning local library facilities.

A subscription to *The Tool Engineer* was presented to the library on behalf of the Chapter by L. H. Tenney, First Vice-Chairman.

Fred Goebler, Plant Engineer at The De Laval Separator Co., was introduced as a new member by J.H. Keller, Secy.

Clyde Fanning, Flint Chapter Education Chairman, presents ASTE membership awards to top-ranking General Motors Institute students, while Chairman Norman Snyder looks on. From left: Alan Stonehouse, Francis Sanders, James Johnson and Charles Schaeffer. Awards were established this year as an annual student competition

Tools of Human Character Needed in Industry

Kansas City, Mo.—Production is the key to survival today as truly as it was in the dawn of recorded history, when Tubalcain and his contemporaries depended upon their ability to fashion an adequate supply of weapons in order to live, A. M. Sargent, ASTE Past President, pointed out in a recent address before Kansas City Chapter.

Mr. Sargent's discussion was inspired by Second Vice-President Robert B. Douglas' communication, published in the January *Andygrams* column of *The Tool Engineer*, concerning this "instructor of every artificer in brass and iron."

Elaborating on this theme, the speaker referred to the present inflationary trend, problems in labor productivity and increased mechanization.

Both management and labor must be further educated in the philosophy of increased production through mechanization, he believes. And "the tools which determine man's moral and mental character must be refurbished and sharpened . . . self-reliance and its companions—initiative, thrift, personal responsibility and moral courage. Equipped with them and with an unshakable faith in what they could accomplish, our forefathers laid the foundation for the American way of life.

"If we are to produce our way out of today's economic chaos . . . these other tools must be brought into action," the speaker declared.

The insidious evils of a paternalistic government, penalizing the economically stable worker for his thrift by compelling him to support the irresponsible and improvident, were scored by Mr. Sargent in his appeal for an educational system "to instill in the minds of each succeeding generation the old-fashioned American ideals."

Ulrich, Superintendent

Toledo, Ohio—Walter L. Ulrich, Past Chairman of Toledo Chapter, has been promoted to Superintendent of Development Group at Willys-Overland Motors, Inc. In this position he will also be in charge of vendors plant tooling, according to a recent announcement.

Machine Tool Executives In Round Table Discussion

Detroit, Mich.—Five outstanding personalities of the machine tool industry participated in a round table discussion December 4 before members and guests of Detroit Chapter.

The panel consisted of Swan E. Bergstrom, Vice-President, The Cincinnati Milling Machine Co.; Benjamin F. Bregi, Executive Engineer, National Broach & Machine Co.; Herbert L. Tigges, Vice-President, Baker Brothers; Lee M. Davis, Asst. Chief Engineer, Jones & Lamson Machine Co.; and Ralph E. Cross, Vice-President and Chief Engineer, The Cross Co.

Their topic was "Developments in Standard and Special Machine Tool Design."

From an aggregate experience of approximately 120 years, the industrial executives briefly traced the history of machine tools, discussed present standard and special machine tools, and what may be expected in tool room and production equipment of the future.

The meeting was one of a series of educational lectures conducted this season by the Chapter.

Tool Engineering Offers Career with a Future

Pontiac, Mich.—"Tool engineering presents one of the most promising futures for young men," Grant S. Wilcox, Jr., ASTE National Director, asserted to members and guests of Pontiac Chapter at a recent meeting in Hotel Pontiac.

More than any other person in industry, he stressed, the tool engineer is responsible for originating and developing new and better manufacturing methods. "If it were not for this engineer, we would never have advanced from the stone age," he said. And a vast, unexplored realm still awaits the engineer of tomorrow, Mr. Wilcox believes.

A film on grinding methods was shown, with James Kitson of the Boys Club operating the projector.

A. J. Rhodes, Chairman, was assisted by Charles Walters, George Bryan, Cash Bond, John Fritcher, Eldon Hall and William Shoup.

G. M. Students Receive Flint Membership Awards

Flint, Mich.—Three General Motors Institute students and one graduate were presented awards at a recent meeting of Flint Chapter at Frankenmuth.

Alan L. Stonehouse, Francis Sanders and James Johnson each received memberships in the Chapter during their senior year for having the highest quality point ratings of all G.M.I. students participating in the Tool, Die and Processing Sequences as Juniors and co-operating with Flint or Saginaw plants.

Charles L. Schaeffer, Bachelor of Industrial Engineering, was awarded a year's membership, a Society pin, and tickets for meetings during the year, in recognition of the quality of his fifth-year project study on tool engineering.

The awards were established this year as an annual competition by the Flint Chapter Education Committee headed by Clyde L. Fanning.

J. A. Koeppen, who resigned as Second Vice-Chairman, was succeeded by Ralph Cook, a charter member.

Technical speaker was S. E. Beer of Monarch Machine Tool Co., Sidney, Ohio, who spoke on "New Developments in Turning Equipment" and showed two films and a few slides.

Controls Cut Labor Costs

Mr. Beer discussed the development of an automatic form turning machine capable of turning a circular piece of stock of stepped contour by following a thin sheet-metal template. An electric tracer follows the template and acts as a guide for the longitudinal and cross feed of the carbide tipped tool.

It was pointed out that, through the use of electric air tracer controls, it is possible for one operator to run two or more lathes. Accuracy of duplication of a "soft" master template can be retained because the air tracer pressure against it is only a few ounces. Duplication accuracy is said to be within .0001" and finish, 8 to 10 micro inches.

The second stage of Mr. Beer's discussion concerned a three dimensional pantographic lathe, capable of machining round, oval, square, or irregular figures in almost any shape or contour to toolroom accuracies.

Geometrical patterns, truer than handwork, are possible on this machine. The master record, machined from a master template, in turn can reproduce the drawing design of the pattern.

A "Believe It or Not" example was shown in motion pictures of the Shapemaster actually turning a square on a lathe.

Made Company Director

Chicago, Ill.—W. R. Mau, Western Sales Manager of Vanadium-Alloys Steel Co., Latrobe, Pa., was recently elected to the Board of Directors at the annual stockholders' meeting, according to a company announcement.

Mr. Mau is affiliated with Chicago Chapter, ASTE.

Los Angeles members visit over their coffee cups at meeting where their fellow member, Robert Walter (at microphone) related his observations of the automobile industry, made during 18 months' stay in Detroit. Fred East (at speaker's right), a former captain of military intelligence, gave talk on atomic bomb damage at Nagasaki

Navy Uses 'Black Light' To Apprehend Pilferers

Los Angeles—Detective Lt. William A. Cummings related his experiences at the Naval Airbase, North Island, San Diego, for Los Angeles members attending a Chapter meeting December 11. One of his assignments in Naval Security was the solution of a wave of thefts at the big base with a transient staff of 26,000.

To apprehend the thieves, Lt. Cummings prepared a powder, invisible under normal circumstances, but fluorescent when exposed to ultra-violet light. In a demonstration with three Chapter members, Lt. Cummings looked away while one picked up a five-dollar bill. When "black light" was projected on the hands of the suspects, one glowed in brilliant iridescence.

After a few similar demonstrations at the naval base, Lt. Cummings told his audience, losses became negligible.

Robert Walter, Consulting Engineer, related impressions of his 18 months' stay in the automotive capital. One trend he perceived was the application of automatic electronic sizing units to special production machines. Heretofore, such units had been used primarily on machine tools.

Large plants, he said, are making ambitious plans to extend their operations to the West Coast. Static in design for six years, the auto industry has been stimulated by the tremendous public acclaim for newcomers in the field. Development laboratories now work on a 24-hour basis for the first time in history, he reported.

Fred East, a former captain of military intelligence, took the audience on a leisurely sightseeing trip into Nagasaki by means of slides and narrative. Actual on-the-scene photographs of buildings devastated by the atomic bomb and incendiary attacks highlighted his talk.

Spiker, Sales Manager

Elizabeth, Pa.—Jess W. Spiker recently became associated, as Sales Manager, with Penn Carbide & Alloy Casting Co.

A member of Pittsburgh Chapter, ASTE, Mr. Spiker was formerly connected with Carbide Die & Mold Co.

Local Products Exhibited By Host Electrical Plant

Milwaukee, Wis.—December meeting of Milwaukee Chapter was held in the gymnasium of Allen-Bradley Co.

Chairman Paul Butzin introduced Whitey Lenhoff who welcomed the members and guests for the management.

A display of electrical switches and apparatus was inspected by the visitors, company engineers answering the many questions asked by the group.

A sports film, "Iced Lightning," was shown, followed by "Popular Science" and "Blondes Away." Badminton and table tennis demonstrations concluded the program.

During a brief business meeting earlier in the evening, Past Chairmen Richard Ford, Otto Wernicke and A. R. Gieringer were elected a Nominating Committee to draw up a slate of Chapter officer candidates.

'Prof.' Oakes Entertains At Annual Dinner Dance

Muncie, Ind.—Second annual dinner dance of Muncie Chapter took place December 12 at the Delaware Country Club.

Following dinner, "Prof." Russell E. Oakes demonstrated some of his amusing inventions, such as the noiseless soup spoon, a spaghetti fork, pea knife, butter protector, "donut" dunker, self-finding golf ball, church collection box, chatter eliminator and hydraulic cigarette lighter.

Later, dancing was enjoyed to the music of Harry Preble and his band. Dinner music was provided by Carol Sue Proudfoot.

Hopper, Supt. at Oneida

Canastota, N. Y.—Clarence H. Hopper has resigned as Production Manager of the ACF-Brill Co. in Philadelphia to accept a position as General Factory Superintendent of Oneida Products Corp.

Mr. Hopper was associated with the Brill Co. for 14 years. Until his removal from Philadelphia, he served as Chairman of the Public Relations Committee for the ASTE Chapter there.

Shows Fixture Designs For Hardness Testing

Toronto, Ont.—"Current Trends in Hardness Testing" were described by V. E. Lysaght of Wilson Mechanical Instrument Co. to an interested audience of Toronto members. Mr. Lysaght was technical speaker at a Chapter meeting December 3.

In detailing microhardness testing of materials with the Knoop Indentor, the speaker explained that his company had developed a technique for producing the indentors on a production basis.

An invention of Frederick Knoop of the National Bureau of Standards, the Knoop Indentor is a diamond ground to a pyramidal form that produces a diamond-shaped indentation having long and short diagonals of approximately 7 to 1 ratio.

It permits hardness determinations of extremely thin metals, exceptionally hard and brittle materials, plated, shallow carburized or nitrated surfaces, or wherever the applied load must be kept below 3,600 drams or even as low as 25 drams.

Automatic with Electronic Control

Enumerating the many uses of the Tukon Tester and its practical adaptations, the speaker pointed out that it is fully automatic under electronic control. An indentation is made by elevating the specimen against the indentor until the hardness of the specimen resists further indentation.

The speaker also mentioned the more familiar Rockwell Tester, its many applications, and fixtures for holding specimens.

The tool engineer, Mr. Lysaght continued, is concerned with designing fixtures to hold specimens in all types of hardness testing instruments.

He illustrated many types of fixtures and various hardness testers in current use. Pinion gears for watches and many other small, delicate parts were tested without difficulty, through advances in testing instrument design and with ingenious fixtures.

Chairman L. N. Jardine presided over the meeting attended by 250 members and friends.

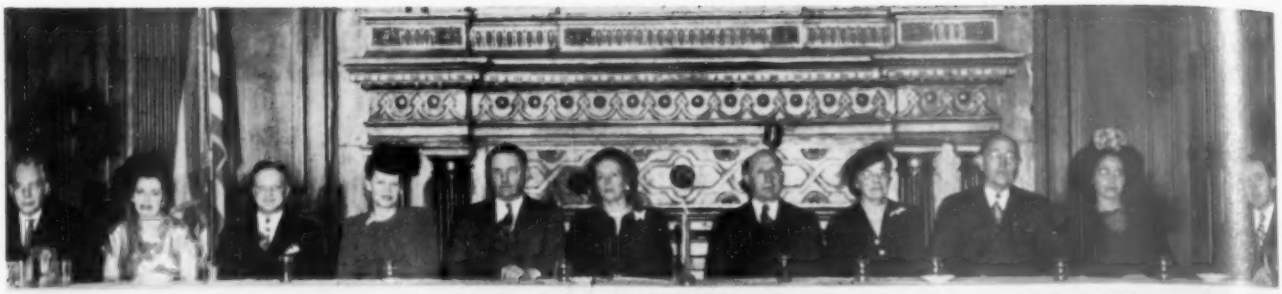
Holds Holiday Stag

San Francisco, Calif.—More than 400 tool engineers and their guests entered into the gay holiday spirit of Golden Gate Chapter's Christmas stag party held December 18 at Club Alabam, San Leandro.

A social hour, dinner and professional entertainment were included in the evening's program. Florindo Viti, Entertainment Chairman, was in charge of the event.

ASME to Meet in South

New Orleans, La.—Spring meeting of The American Society of Mechanical Engineers will be held here March 1-4 with headquarters at St. Charles Hotel, according to an announcement by Ernest Hartford, Executive Assistant Secretary, 29 W. 39th St., New York 18, N. Y.



Pittsburgh Chapter executives and their wives occupying officers' table at Ladies Night Christmas party are, from left: H. L. Harper, Secy.; Mrs. Harper, F. T. Boyd, 2nd V.-Chm.; Mrs. Boyd, W. S. Risser, 1st V.-Chm.; Mrs. Risser, P. H. Magnus, Chm.; Mrs. W. B. Peirce, President Peirce, Mrs. G. C. Wood, and Mr. Wood, Chapter Treas.

32 Thread Cutting Speeds Feature of New Automatic

Montreal, Que.—Sixteen work-spindle speeds from 454 to 5,000 rpm., and 32 threading-spindle speeds from 545 to 7,000 rpm. are available on a new automatic screw threading machine, according to A. R. Sparrow, Superintendent, Screw Machine Department, Brown and Sharpe Co., Providence, R. I. Mr. Sparrow discussed "Automatic Screw Machines and Tooling Applications" at the December 10 meeting of Montreal Chapter in the Windsor Station dining room.

The new machine gives 32 changes of thread-cutting speeds, 91 to 2,000 rpm. (the difference between speeds of work and speeds of threading spindles), Mr. Sparrow added, the work spindles and threading spindles rotating in the same direction at different speeds.

The variance permits the die or tap to cut at the required threading speed while the work rotates with sufficient rapidity for turning or other operations. Dies are backed off by automatic stopping of the threading spindle.

Aided by descriptive slides of late model screw machines and pinion turning machines, and line drawings of typical workpieces, the speaker went on to describe improvements made in this type of equipment during the past few years.

Has Slotting Mechanism

Designed to give unusually high production of small screws, nuts and bushings, by taking advantage of overlapping operations, and by reduction of idle time, the latest model automatic screw machine is equipped with a slotting mechanism for screws and similar parts, he explained. When the machine is used for tapping, the slotting mechanism provides for drilling the hole prior to tapping.

Other features described were chain drives, take up devices to eliminate slack, reduction of indexing time, safety clutches and shear pins, a swinging stop, a permanent gauge for the accurate setting of cutting tools on center, provisions for performing several operations simultaneously, electrically operated feeding devices, and transfer fingers for work requiring operations on both ends.

A sound film, "Oil from the Earth", depicted the formation in prehistoric ages of vast deposits of oil and how scientists have discovered them.

The 90 members and guests present constituted a record for the season.

Situations Wanted

FACTORY OR PRODUCTION MANAGER or Superintendent seeks permanent position with a progressive concern. Experience includes knowledge for material procurement and handling, maintenance, precision production and jobbing work, production engineering and planning, tool design and toolmaking, plant layout, press work and gray iron foundry. References and complete resume available upon request. Please address replies to Box 139, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

SALES ENGINEER—District representative for special machines and tools for Michigan industry. Fifteen years' experience. Can furnish excellent reference. Box 140, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

Dancing, Entertainment Highlight Ladies Night

Pittsburgh, Pa.—Pittsburgh Tool Engineers entertained the fair sex at the Chapter's Third Annual Ladies' Night Christmas Party, December 19.

Seventy couples sat down to dinner in Fort Pitt Hotel, many participating in dinner dancing to an orchestra which played throughout the evening.

Professional entertainment included acrobatic dancing, vocal and instrumental numbers, marionette and novelty acts, and comedy skits.

After the show, dancing and merriment continued. Gold and silver compacts were presented to the ladies.

Among those attending the affair were President and Mrs. W. B. Peirce, their daughter, Mrs. G. C. Wood, and Mr. Wood, Chapter Treasurer.

Stresses Tooling Economy

Hamilton, Ont.—J. R. Keen of the Gisholt Machine Co. discussed "Turret and Automatic Lathes" before 65 members and guests attending a dinner meeting of Hamilton Chapter, December 11, at Fischer's Hotel.

Mr. Keen centered his talk around the economics of tooling, stressing the necessity of proper tooling for long runs at low unit cost.

Steel Subjects Featured In Buffalo Lecture Series

Buffalo, N. Y.—A series of lectures concerning the selection, application, heat treating and testing of commercial steels and tool steels is being sponsored by Buffalo-Niagara Frontier Chapter, Wednesday evenings at Grosvenor Library Auditorium.

Purpose of the course is to refresh those interested in steel practices. Presented in practical language by prominent metallurgists, most of the lectures are illustrated with slides and sound films.

Forthcoming programs are scheduled as follows: February 18—"Cold Work Die Steels," Dr. J. E. Wilson, Metallurgical Engineer, Brace-Muller-Huntley, Inc., Buffalo, N. Y.; February 25—"High Speed Tool Steels, Their Application and Heat Treatment," Dr. George A. Roberts, Chief Metallurgist, Vanadium-Alloys Steel Co., Latrobe, Pa.

March 3—"Drop Forge Die Steels and Other Hot Work Steels," Charles A. Bennett, Brace-Muller-Huntley, Inc., Syracuse, N. Y.; and March 17—"Shock Resisting and Other Tool Steels," Dr. Wilson.

Earlier lectures included: "The Making and Shaping of Steel," James J. Henderson, Manager of Sales, Carnegie-Illinois Steel Corp., Buffalo; "Commercial Steels," Joseph M. Engle, Supervisor of Metallurgy, Republic Steel Corp., Buffalo; and "Carbon Tool Steels," Dr. Wilson.

A presentation of the Chapter Education Committee, headed by Earl J. Boggan, Sr., the lectures begin at 7:30 P. M., include a question and answer period, and are offered gratis.

Family Night Observed

Fort Wayne, Ind.—Approximately 200 members, their families and special invited guests of Fort Wayne Chapter were entertained by the Earlham College Choir at Dennis Junior High Auditorium December 9. The variety program consisted of vocal and instrumental music, native songs and dances, humorous skits and monologues.

Performers included Howard Roberts, magician; Winifred Chasteen, Nellie Trockne, Grace Chu, Dail Cox, Sue Foster, Edward Lee, Albert Cobine and Robert Godsey, soloists; Robert Byrd, Sing Sheng, Corrine Gray, accompanists; and Helen Bowles, Hawaian dancer.

New Tooling System Cuts Handling, Speeds Work

South Bend, Ind.—Clare Bryan, Consulting Tool Engineer for Link-Belt Co., addressed South Bend Chapter at their December meeting.

The speaker told of the standardization program developed by his company through the use of hydraulic clamps and adjustable stops. An entirely new tooling system has been used for machining gear reducer housings, with a reduction of handling time and operation speed-up of as much as 45 per cent.

Hydraulic pressures of 1000 to 1400 lbs. have been developed, Mr. Bryan stated, by using special air intensifiers connected to a 65-lb. air line. Quick acting couplings are then used to transfer high pressure oil to piston type clamps on the various jigs.

He cited several examples of boring on large castings in which tolerances of ten thousandths of an inch were achieved with hardened Meehanite bushings and a special oiling system.

'Magician' Kuntz Performs For Holiday Party Guests

Columbus, Ohio—Approximately 100 members and guests participated in Columbus Chapter's annual Christmas party held December 8 at Hotel Fort Hayes.

A social hour was followed by dinner, with music furnished by a three-piece ensemble. After dinner, Chairman W. E. L. Bock introduced Robert Kuntz of Dayton Chapter, who presented "Fool Engineering," an amateur magician's act.

At the conclusion of the program, small groups gathered at card tables, around the piano and in the lounge to enjoy refreshments and good comradeship.

Drowne, Agent for Arter

Worcester, Mass.—E. S. Drowne, Jr., has been appointed exclusive selling agent for the Arter Grinding Machine Co., in Maine, New Hampshire, Vermont, Massachusetts and Rhode Island, according to a recent announcement by A. B. O'Donnell, Sales Manager. Mr. Drowne, a well-known manufacturers' agent, is a member of Boston Chapter, ASTE.

Television Research Improves Reception

Philadelphia, Pa.—One of the outstanding postwar developments in television engineering and research is the "Micro-Lens" screen, curved in a special way, coated and scored to achieve the effect of millions of tiny lenses which diffuse the light striking the screen, according to Edward B. Lucas, Jr., of the Public Relations Dept., Philco Corp.

Speaking before a recent meeting of Philadelphia Chapter, Mr. Lucas described how the new screen directs and focuses all the light from the cathode ray picture tube toward the viewer, enhancing the brightness of the picture. Since the screen will not reflect ambient light, the set can be viewed in daylight or in a normally lighted room.

An entirely new optical system, utilizing a series of mirror reflectors and a correcting lens, projects a large image 15″ x 20″.

In addition to explaining this and other types of receivers, Mr. Lucas reviewed the rapidly expanding new industry, broadcasting and programs lending themselves to visual projection, as well as the underground and aerial methods of relaying broadcasts.

Palmer M. Craig, Chief Engineer of the Radio Div. of Philco, spoke on problems involved in engineering for television and answered questions.

At the conclusion of the discussion, there was a television demonstration depicting Princess Elizabeth's wedding.

Guests at the meeting included Joseph Veasey, Section Engineer; E. Maxham, Consulting Engineer; E. O. Barton, Mechanical Engineer, and W. Goldacker, Project Engineer, both of the Radio Div.; and J. Gerstemeier, Tool Engineer, all of Philco Corp.

William Battersby, one of the four founders of the Chapter, was welcomed back after a long illness.

IDA to Increase Service

Atlantic City, N. J.—Annual meeting of the Industrial Diamond Association of America, Inc., held here January 28-30, featured plans for added service to American industry, through education in plants and colleges, and by publication.

New Procedure Speeds Data Sheet Activity

Detroit, Mich.—Accelerated data sheet activity among Chapter Standards Committees is resulting from the personal contacts and assistance of S. F. Girard, National Standards Committee Secretary, according to W. H. Smila, Chairman.

Through joint meetings of local Standards Committees and invited area manufacturers, the latter are indoctrinated with the mechanics of the ASTE data sheet program, eliminating the necessity of individual contact by Chapter Standards Committeemen.

Companies sponsoring data sheets, following this procedure, include Rockford Magnetic Products Co., Micro Switch Co., Metal Cutting Tools, Inc., Dumore Co., Eclipse Counterbore Co., Gairing Tool Co., Delta Mfg. Co., Twin Disc Clutch Co. and others.

Mr. Girard plans to visit other Chapter Standards Committees to aid them in organizing similar meetings.

Equipment Choice Vital In Mold and Die Making

Grand Rapids, Mich.—The most efficient methods in making molds and dies are obtained by selecting proper equipment for each operation, according to D. V. Stevens of Kearney & Trecker Corp., Milwaukee, Wis., who addressed Western Michigan Chapter recently.

Methods of making tools and dies, enumerated by Mr. Stevens, are with (1) standard tool room equipment; (2) duplicating machinery; (3) pantographing; (4) hobbing; and (5) rotary head milling.

His discussion, dealing largely with molds for die casting and plastics, was illustrated with slides and actual specimens of molded plastics.

Chicago Conference, Show Scheduled for March 22-4

Chicago, Ill.—The Chicago Technical Conference and Chicago Production Show will be conducted simultaneously by the Chicago Technical Societies Council, March 22, 23, 24, at the Stevens Hotel, according to an announcement by Paul A. Jenkins, Executive Secretary.

Philadelphia Chapter officers had Philco Corp. engineers as guests at recent meeting featuring television program. From left: E. Maxham, Consulting Engineer; W. W. Cady, Chapter Secretary; E. O. Barton, Mechanical Engineer; S. L. Boyer, 1st Vice-Chairman; E. B. Lucas, Jr., of Philco Public Relations Dept.; A. R. Diamond, Chairman; P. M. Craig, Chief Engineer; Emil Kitzman, 2nd Vice-Chairman; John Gerstemeier, Tool Engineer; T. J. Donovan, Jr., Director; and Joseph Veasey, Section Engineer

Quality Control Replaces Wasteful Parts Rejection

Pittsburgh, Pa.—Regardless of how closely it conforms to the design, until a tool actually produces parts which meet specifications, it cannot be accepted, Joseph B. Manuele, Director of Quality Control for Westinghouse Electric Corp., stressed in an address before Pittsburgh Chapter, December 5.

He contrasted the former wastefulness of separating rejects from acceptable parts in an inspection department, with the efficiency of statistical control whereby quality can be predicted, and controlled at any desired level.

Joseph Manuele, Director of Quality Control for Westinghouse Electric Corp. tells Pittsburgh Chapter group advantages of statistical quality control

Production can be increased as much as 30-35%, and unit costs reduced to the extent that scrap is eliminated and reworking of sub-standard parts is unnecessary. Stability in the manufacturing process also assures higher operator earnings, where incentive plans are in effect, according to Mr. Manuele.

An efficient and well administered quality control program, the speaker summarized, demands that the tool be: (1) properly designed for performing the required operation, (2) built in accordance with the design specifications, (3) tried in actual production, and that the quality of parts produced be analyzed to determine average quality and range of variation in quality, and (4) reworked to correct the average quality to the desired value, and that the range of variability in quality be narrowed to the allowable tolerances.

Slides illustrated Mr. Manuele's talk, and a lively open discussion followed.

During the meeting a petition, presented by Robert W. Ford, National Program Chairman, and providing that area or regional meetings be substituted for national semi-annual conventions, was signed by the membership.

President W. B. Pierce commented briefly on the petition and on the forthcoming Cleveland exposition.

A Past Chairman pin was presented to William H. Schott by W. S. Risser, First Vice-Chairman. Mr. Risser also introduced the technical speaker.

Complimentary letters from guests attending the recent Executives' Night were read by H. L. Harper, Secretary.

Coming Meetings

ALL CHAPTERS—February. Election of Chapter Officers, Delegates and Alternates. March. Installation of officers.

ATLANTA—February 16. Speaker: A. E. Rylander, Technical Editor, *The Tool Engineer*. Subject: "The Tool Engineer's Place in Modern Society." March 15. Ladies' Night.

CLEVELAND—February 13. Special Feature. Social hour. March 15-19, ASTE Tool Engineer's Industrial Exposition and 16th Annual Meeting. Cleveland Public Auditorium. March 17-18, Board of Directors Meeting; March 18, House of Delegates Meeting, Hotel Cleveland; Annual Dinner, Carter Hotel.

DENVER—March 4, Oxford Hotel. Speaker: H. C. Hurtt, Service Rep., Cleveland Twist Drill Co. Subject: "The Use and Abuse of the Twist Drill."

ELMIRA—March 1, 7:00 P. M., Mark Twain Hotel. Speaker: William J. Farrell, Asst. to Vice-Pres., Sciaky Bros., Inc., Chicago, Ill. Subject: "Production Welding."

ERIE—March 2. Speaker: Dr. A. O. Schmidt, Research Engineer, Kearney & Trecker Corp. Subject: "Fundamentals of Metal Cutting."

FLINT—February 19. Speaker from Severance Tool Industries, Inc., Saginaw, Mich. Subject: "Midget Milling Cutters." March 18. Subject: "What's New in Centerless Grinding," sponsored by the Cincinnati Milling Machine Co.

HAMILTON—February 13, 7:00 P. M., Ava Golf Club, Brantford, Ont. Members' night with Chapter speakers on various subjects.

HARTFORD—March 1. Speaker: Henry Burnette of Pratt & Whitney Aircraft. Subject: "Electronics in Gaging and Machine Control."

MILWAUKEE—February 13. Speaker: Ernest Flanders, Jones & Lamson Machine Co., Springfield, Vt. Subject: "Thread Grinding and Its Applications in the Modern Machine Shop." March 11. Speaker from The Fellows Gear Shaper Co., Springfield, Vt. Subject: "Generating of Gears."

PITTSBURGH—March 5. Dinner 6:30 P. M.; meeting 8 P. M., Fort Pitt Hotel. Speaker from Pittsburgh Plate Glass Co. Subject: "Color Dynamics."

TOLEDO—March 10, 7:00 P. M., Secor Hotel. Speaker to be announced.

Holiday Party for Ladies

Cedar Rapids, Iowa—One hundred and sixty-five Cedar Rapids members and their feminine guests attended the Chapter's annual Ladies Night, December 17, in the Grand Ballroom of the Montrose Hotel.

"Prof." Russell E. Oakes entertained with his absurd inventions, and dancing was enjoyed by the entire company. The ladies were presented with corsages appropriate to the Christmas season.

Powdered Metal Bearings Have Several Advantages

Williamsport, Pa.—December meeting of Williamsport Chapter featured D. C. Martin, Amplex Div., Chrysler Corp., who described the making of powdered metal machine parts.

The metals selected, said Mr. Martin, are first powdered, then mechanically mixed, and moulded. The temperature of the moulded part is then raised to a heat between the melting points of the respective metals, fusing the mass.

Next operation is to compress the part to finish dimensions, approximately one-third of its original size. Being porous, the completed part can hold approximately 30% by volume of oil, thus requiring little attention for lubrication.

Principal use of these products is in bearings, which are easily installed, uniform in quality, more economical where practical, self lubricating and dripless. Other applications of powder metallurgy include thrust washers, gears, and filters which may be used as flame traps.

E. H. Sears of Carey McFall Co. discussed industrial applications of infra-red heating. Penetration of the infra-red rays produces internal heat, drying parts from the inside out.

In the case of pottery, this is a very valuable attribute of the process, revealing cracks and imperfections early in the drying operation. This type of heating is used also in drying paint and textiles and in curing rubber.

Obituaries

Thomas G. Caywood

Thomas G. Caywood, 60, Professor of Mechanical Engineering at the State University of Iowa, Iowa City, recently passed away.

Born at Somerset, Ohio, the future educator was graduated in Mechanical Engineering from Ohio State University.

Prior to becoming instructor in machine design at the University of Iowa, he held engineering positions in industry. During the recent World War, Professor Caywood conducted government classes in tool engineering at the University.

A charter member of Cedar Rapids Chapter, ASTE, he was Education Chairman at the time of his death. He had been affiliated also with SPEE and was a member of the Iowa City Engineering Club.

Prescott R. Lovejoy

Prescott R. Lovejoy, 45, President and General Manager, Lovejoy Tool Co., Inc., Springfield, Vt., died December 24 following a lingering illness.

Mr. Lovejoy was a native of Springfield and a graduate of the University of Vermont with a degree in Mechanical Engineering. After short periods with The Fellows Gear Shaper Co. and Jones & Lamson Machine Co., he became associated with Lovejoy Tool Co. in 1926 and was made President in 1940.

He was the incumbent Treasurer of Twin States Chapter, ASTE.

North East West South in Industry

JAMES WALKER, whose series of articles on Drawing Die Problems and Formulae have aroused wide interest among readers of *The Tool Engineer*, has resigned his position with Consolidated Vultee Aircraft Co., Ft. Worth, Tex., and is now Ass't Supt. with **Worcester Pressed Steel Co.**, Worcester, Mass.

J. SCHUYLER CASEY, Pres., M. H. Treadwell Co., Inc., New York, was elected President of the **United Engineering Trustees, Inc.**, at its recent annual meeting.

HAROLD O. HILL, engineering executive of Bethlehem Steel Co., has taken office as President of the **American Welding Society**.

The Carborundum Company has engaged the services of **CHARLES B. PROUNDFOOT**, formerly with Fredric Flader, Inc., as Senior Research Eng'r in Physics at the Research and Development Laboratory, Niagara Falls.

JOHN E. MARTIN, formerly V.P. of American Type Founders, Inc., is now Pres. of **The Firestone Steel Products Co.**, Akron.

C. A. JURGENSEN, for many years associated with **De Laval Steam Turbine Co.**, Trenton, N. J., has been appointed acting Works Manager.

B. W. ROGERS COMPANY, 850 So. High St., Akron, Ohio have been appointed sales representatives for the **John S. Barnes Corp'n** hydraulic equipment. The firm has also been named distributor for industrial tube fittings and valves by **The Parker Appliance Company**.

Recently elected officers of the **ELECTRIC INDUSTRIAL TRUCK ASS'N** include **F. J. Shepard, Jr.**, Lewis-Shepard Products, Inc., Pres.; **W. Van C. Brandt**, The Electric Storage Battery Co., V.P.; **Charles F. Kells**, managing director of EITA, Sec'y-Treas.

A large addition to the warehouse facilities of the **AMALGAMATED STEEL CORP'N**, Cleveland, Ohio, will soon be built to meet the rapidly growing **Malga Steel Service** requirements.

Three staff additions to the **University of Wichita FOUNDATION FOR INDUSTRIAL RESEARCH** have broadened the research services available to industry. Added are **Arthur C. Risser**, industrial designer; **LaRue Wangerin**, agricultural and research engineer; and **Arthur M. Lennie**, industrial consultant and metallurgical engineer.

WALTER E. WINFREY CO., 238 Main St., Cambridge, will represent **Baldor Electric Co.** in Massachusetts.

Sales and advertising offices of **THE RAPIDS-STANDARD COMPANY, INC.**, mfrs. of material handling equipment, have been moved from The Peoples National Bank Bldg. to enlarged quarters at The Rapistan Bldg., Grand Rapids 2, Mich.

George R. Vassily will represent **E. W. BLISS COMPANY** in the sales of mechanical and hydraulic presses and can machinery in the Pittsburgh area.

Appointments by **THE CARBORUNDUM COMPANY** include **W. T. McCargo**, Ass't Director of Sales, in charge of Western Operations, headquarters at Chicago; **John S. Hawley**, Ass't Director of Sales, Central Region, headquarters at Cleveland; **John G. Fritzinger**, Ass't Director of Sales, Eastern Region, headquarters in Philadelphia; and **R. R. Huntington**, District Sales Mgr. at Philadelphia.

The **Robertshaw Thermostat Co.**, Youngwood, Penna., **The Fulton Sylphon Co.**, Knoxville, Tenn., and the **Bridgeport Thermostat Co., Inc.**, of Bridgeport, Conn., have merged under the name of **ROBERTSHAW-FULTON CONTROLS COMPANY**, in order to coordinate research activity and interchange engineering and manufacturing experience. The merging companies will be operated as divisions of the new organization.

The newly formed **MARCO MANUFACTURING CORP'N** has acquired manufacturing facilities at 21930 Grosbeck Hwy., East Detroit. The new plant provides adequate capacity for producing stampings and stamping assemblies. Marco Manufacturing is an outgrowth of the **Mardigian Corp'n**, a major producer of engine parts and automotive stampings.

Recently, **SIMONDS SAW AND STEEL CO.**, at Fitchburg, Mass., held open house in what is considered the World's first Windowless Controlled Conditions Plant. Commanding a view of the entire 5 acres of straight-line production, is the "Little Red Schoolhouse", where company and distributor salesmen are given a comprehensive picture of the part Simonds products play in industry in many fields. True replicas of industrial scenes, in miniature, show Simonds saws felling trees or trimming logs, circular saws cold cutting steel bars, squaring shears cutting thin sheet metal, and so on . . . certainly a unique and effective training method for supplementing films or previewing field study.

OHIO STATE UNIVERSITY's pioneering in the field of welding engineering has culminated in the establishment of a Department of Welding Engineering, offering a complete course of study leading to a degree of Bachelor of Welding Engineering.

The **Induction Heating Div'n** of **THE BUDD COMPANY** has been purchased by **The Ohio Crankshaft Co.** for its **TOCCO DIV'N.** Purchase includes machinery, equipment, inventories, and patents but not the land or buildings. The acquisition will add to the line offered by Tocco, while The Budd Co. will be able to concentrate on the manufacture of products in the automotive and railway fields.

The **AMERICAN METALLIZING CONTRACTORS ASS'N** has been chartered by the State of Illinois. Founded by eight of the country's largest metallizing contract shops, the prime purpose is to serve as a central clearing house for technical information needed by the industry. President is **William Fatka**, of Metallizing, Inc., Chicago, and Sec'y-Treas. is **Walter B. Meyer**, with office at 773 Brownell Ave., St. Louis 22, Mo.

Recent **General Electric** appointments include **HENRY V. ERBEN**, V.P. and Gen'l Mgr. of the Apparatus Dept., succeeding **Roy C. Muir**, retiring; **JOHN D. LOCKTON**, Treas., succeeding **Jesse W. Lewis**, retiring; **F. K. McCUNE**, Ass't to Mr. Erben; **J. F. ECKEL**, Mgr. of the Lynn River Works, succeeding **George M. Stevens**, retiring.

Sales of **The Carpenter Steel Company** in the Philadelphia-Reading territory will be directed by **Norman C. Einwechter**, Ass't to the V.P.

ROBERT E. BUSEY comes from the White Motor Co. to be Ass't Chief Eng'r at **Willys-Overland Motors.**

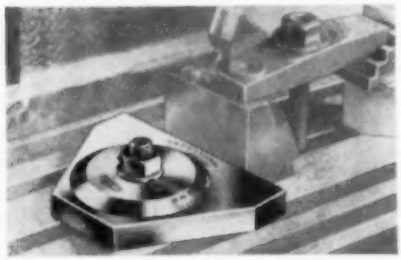
Appointments made at **The Lincoln Electric Co.** include **G. E. TENNEY** as Service Manager and **THOMAS V. KOYKKA**, an attorney, to the Board of Directors to fill the unexpired term of his partner, the late W. B. Stewart.

SAMUEL KOFFSKY will continue as chief engineer of the **Simmons Machine Tool Corp'n**, Albany, N. Y., while assuming added responsibilities as Gen'l Mgr. of the **Simmons Fastener Corp'n.**

EASTERN CARBIDE CORP'N, 909 Main St., New Rochelle, N. Y., has been formed to offer manufacturers complete carbide service, including base metal and finished tools and dies. The firm is eastern distributor for **Wendt-Sonis Co.**, mfrs. of carbide cutting tools.

TOOLS OF TODAY

Machine Table Protractor



A new **MACHINE TABLE PROTRACTOR**, developed by the *Taft-Peirce Mfg. Company*, provides a quick and accurate method of obtaining angular locating surfaces on miller and other machine tool tables. Constructed of hardened and precision ground steel parts, and designed to accommodate standard size tongues to fit conventional T-Slots, the tool incorporates a graduated index plate, with a vernier scale, to provide accurate settings to within 5 minutes of angle. **T-2-1**

New Book Truck

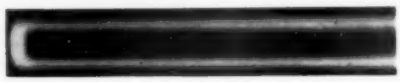
While designed especially for curing rubber in process, a new **BOOK TRUCK**, by the *Palmer-Shile Company*, can also be used for rapid drying or curing of plastics and other products in sheet form. The truck, which is ordinarily equipped with metal or rubber tired wheels, or casters, can be built with legs or skids to accommodate power lift or hand operated trucks.

Construction is of heavy gauge steel, all welded, and long, sturdy extension springs permit easy raising and lowering of the shelves which, when raised, are automatically held in tilted position to provide complete accessibility from any position.

For Tool Engineer's Service Bureau, see insert facing page 106. **T-2-2**

Thermocouple Protector

A heavy-wall, cast iron **THERMOCOUPLE PROTECTING TUBE**, by the *Claud S. Gordon Company*, is said to have considerably longer life and to be more practical and economical than the ordinary cast iron tube used for molten aluminum, zinc and die casting metals.



Furnished with ⅜" wall thickness and 15/16" inside diameter, these "Serv-rite" tubes, as they are called, are cast with both ends open. A special technique is employed for weld closing one end, and porosity in the casting is eliminated by the addition of a small amount of alloying element. **T-2-3**

Center Lapping Tool

An original development in carbide tools is a Solid Carbide **CENTER-LAPPING TOOL**, by *Raymac Mfg. Co.* Available in sizes ½" x 1½" and ⅜" x 1½"—60° inclined angle—the new tool is designed to replace abrasives and can be used in standard center lapping machines or drill presses in working metals up to 62-65 C scale Rockwell hardness. The tools may be reconditioned up 50 times with no change in quality of operation.

T-2-4

Combination Crane-Tractor

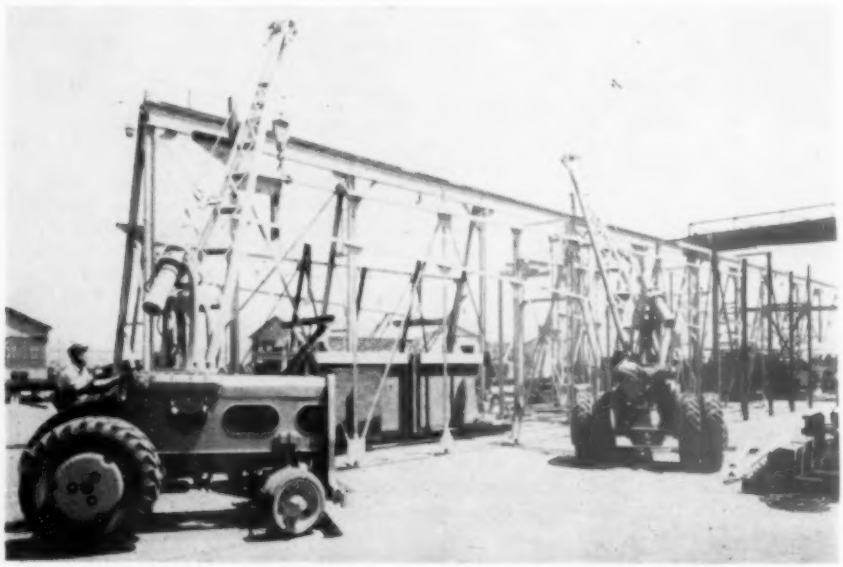
A compact, powerful and rapidly mobile **CRANE**, capable of handling up to 4 tons, is announced by the *Joshua Hendy Company*. Named the Model U "Handi-Crane," the unit is mounted on a Model UTI Minneapolis Moline Tractor, equipped with rear power take-off and a pintle hook drawbar; hence, it can be used for tractor purposes as well as for crane lifts.

Enclosed stabilizers permit free front axle movement, yet provide positive support when swinging a load. Radiator and wheels are protected against damage from swinging loads by an extra heavy radiator guard and a box-type bumper. The rugged front end construction includes a 72" axle, heavy steering spindles and reach rod, and heavy cast wheels, with 28" x 10" solid cushion tires providing lower ground bearing pressure.

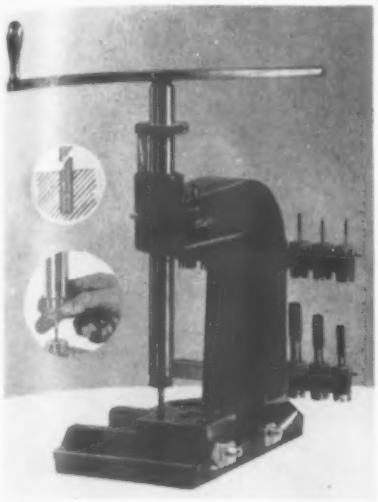
The boom is raised and lowered by a hydraulic cylinder, mounted on the gantry and controlled by a valve at the right of the steering wheel, thus providing independent boom topping at all times with absolute speed control. The turntable, which is full-revolving, rides between two rows of large diameter steel balls running in flame-hardened races grooved in the turntable casting.

The operators' seat is offset, for visibility for traveling or crane operation, and the three crane controls—swing, hoist drum and boom topping—are within easy reach of the operator. The unit is currently distributed by the Industrial Equipment Company, of Los Angeles and Oakland, Cal., and those interested may obtain an Angular and Linear Load Chart, and Radius Diagram, from either the distributor or the manufacturer.

T-2-5



Hand Tapper and Threader



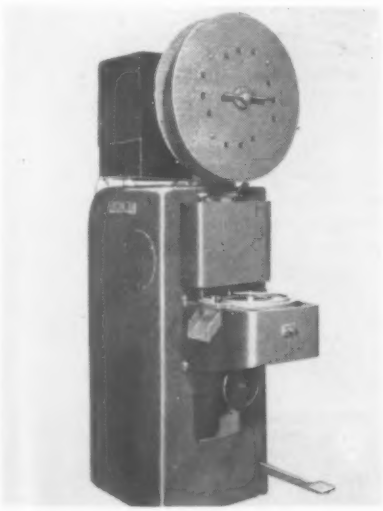
Designed for bench or wall mounting, a **HAND TAPPER**, by *Lassy Tool Company*, incorporates a direct reading depth gage, which can be set short of the depth of a hole to prevent taps from bottoming in behind holes and thereby breaking, and stepped holding bars to hold work being tapped. Tap capacity is ⅛" to 1" inclusive, and the set includes hardened and ground Q. C. adapters for various size taps. The tap adapter racks may be detached if desired to mount them on the tool crib.

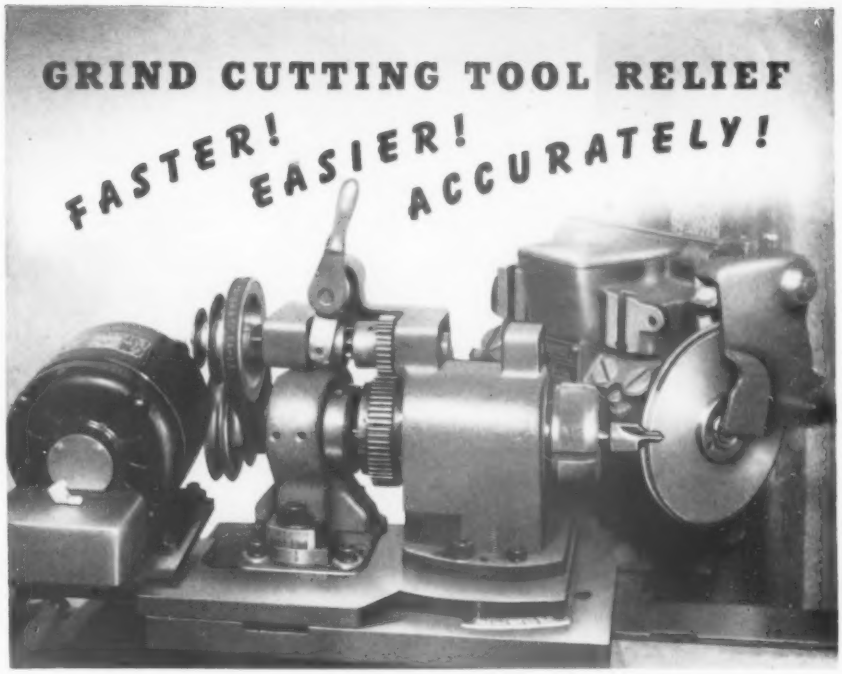
T-2-6

Special Purpose Welder

Designated Type SP2, a special purpose automatic **BUTT WELDER**, by the *Agnew Electric Company*, features automatic cycle and fully synchronous control of welding current and time. Designed for welding nickel ground wire to spark plug shells, the operator has merely to place the parts in holders on the index table; from then on, during the cycle, the wire is taken from the reel, fed to length, clamped, cut off, and welded to the shell. The finished part is automatically ejected. Output is stated at 3600 pieces per hour.

T-2-7





WITH THE

CIRCULARITY-GRINDING ATTACHMENT

for

- ★ FORM RELIEF—RADIAL RELIEF—FORM AND RADIAL TOGETHER—STRAIGHT AND TAPERED CYLINDRICAL GRINDING.
- ★ EASILY MOUNTED ON ALL UNIVERSAL AND CUTTER GRINDERS.
- ★ WORK HELD BETWEEN DEAD CENTERS OR IN COLLET.
- ★ NO SPECIAL CAMS OF FIXTURES NEEDED FOR ANY SET-UP.

DEVELOPED by the Detroit Reamer & Tool Company, the Circularity-Grinding Attachment has been used successfully for several years in the manufacture and reworking of cutting tools. Form relief, radial relief, form and radial relief together, straight and tapered cylindrical work all may be accurately ground with this attachment . . . thus in many places it replaces a motor-driven headstock.

The work may be held in a collet (0" to 1¼") or between dead centers. In either case the work always revolves on its own axial center. Set-ups are simple and the Circularity-Grinding Attachment provides identical relief on every tool ground from the same set-up.

Send for our new illustrated bulletin which gives complete explanation of set-up and operation of the Attachment. Write today.

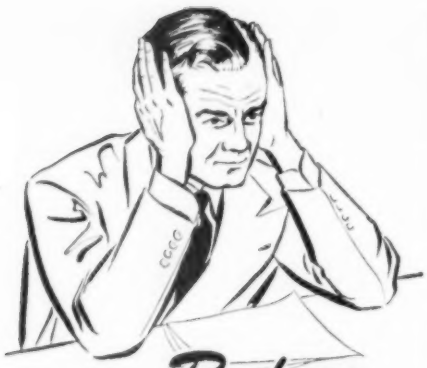
SEE IT AT BOOTH 608 — A.S.T.E. SHOW

D R & T COMPANY

DETROIT REAMER & TOOL CO.

Mfrs. of Special High Speed Cutting Tools

2830 East 7 Mile Rd. Detroit 12, Michigan



Reduce Production Headaches!

. . . use the right Cutting Fluid!

Questions concerning use and application of cutting fluids are the cause of many shop headaches. When critical parts have to be rejected and finishes are bad and tools have to be sharpened frequently, jobs go sour and schedules aren't met, cutting oils may be at the bottom of it. D. A. Stuart Oil Co. representatives have had plenty of experience in straightening out such situations, developing the correct application, improving production —curing the headaches. Let them prescribe for you.

Here's an oil . . .

THAT WILL HELP YOU—

D. A. STUART'S KLEENKUT WATER-MIXED CUTTING OIL

Stuart's Controlled KleenKut water-mixed cutting oil has a long established, consistent record of excellent performance on the majority of metal-cutting operations. On drilling, reaming, sawing, tough turning, machining cast iron, cutting bolt threads, planing and milling, and other jobs where cooling qualities or cleanability are dominant requirements, KLEENKUT has meant machining excellence since 1912 . . . Carries off heat rapidly . . . Increases tool life . . . Improves finishes . . . Flushes chips and contaminants from the work area . . . Reduces power consumption . . . Contains only top-quality ingredients . . . Chemically stable . . . Free from objectionable odor . . . Simple to clean from parts or machines . . . Mixes freely with water. *ANOTHER TIME-TESTED STUART PRODUCT!*

STUART *oil engineering goes with every barrel*

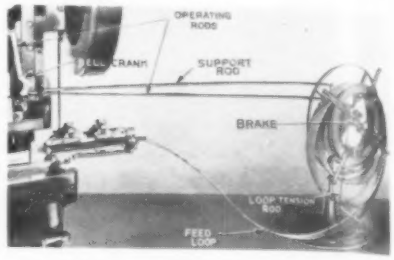
D.A. Stuart Oil Co.

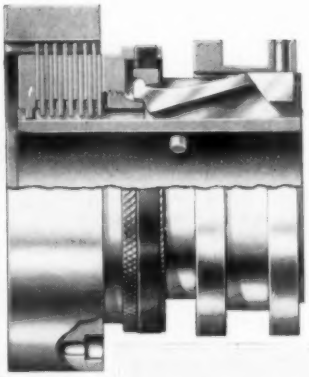
2727-49 SOUTH TROY STREET, CHICAGO 23, ILL.

Automatic Stock Reel

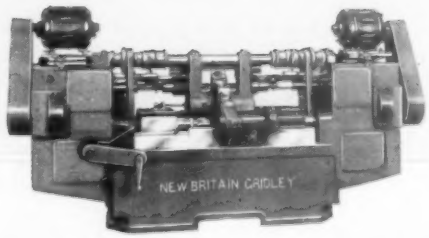
Developed by the *H. E. Dickerman Mfg. Co.*, for use in the stamping industry, an **AUTOMATIC STOCK REEL** unreels stock from either the top or bottom of a coil at a controlled rate as required by the die being fed. Power for operating is obtained from the press and, therefore, the reel requires neither electric motor nor gear reducer.

Control of the amount of unreeling is accomplished by means of two simple devices, one, a spring loaded friction brake on the hub of the reel, the other a pawl lifter. Over-running of the reel is prevented by the brake, while the amount of unreeling is governed by the tension of the stock loop which causes the pawl lifter to either lift the pawl free of the rack gear or allow the pawl to engage the rack gear and rotate the reel. Mounted on a large diameter base for stability, the stock reel is adjustable to accommodate various stock coil diameters and widths. T-2-8





MAXITORQ keeps Good Company



THE MAXITORQ Floating Disc Clutch was designed to solve certain power transmission problems, especially those formerly encountered in automatic machine tool operation. As evidence that MAXITORQ design has proven successful we show the new Double End Tool Rotating Chucking Machine, manufactured by New Britain-Gridley Machine Division.

Normally two single clutches are used in this model . . . one to control feed motions, the other for control of the rapid transverse. When threading is done, at either or both ends of the machine, one double clutch serves each spindle.

May we suggest that Designers and Manufacturers of machine tools, and other machinery, ask for our detailed bulletin. It contains information you need . . . about the clutch you can use . . . profitably.

Send for Catalog No. TE2

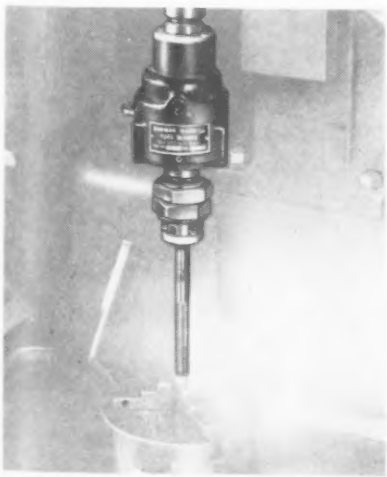
THE CARLYLE JOHNSON MACHINE COMPANY
MANCHESTER • CONNECTICUT

Compact Surface Grinder

A new **SURFACE GRINDER,** by *Leach Machinery Company,* is a self-centered unit with a 2-speed ball bearing spindle driven by a ¾ HP motor. Capacity is 6" x 12", using a standard 5" x 10" magnetic chuck and 7" x ½" x 1¼" wheel. **T-2-9**

Combination Threading Tool

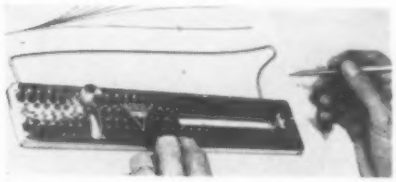
DIE HOLDER ASSEMBLIES, which permit the use of all sizes Dorman Tappers for external threading in addition to conventional machine tapping, are now available from the *Dorman Machine Tool Works.* The Tappers can be furnished with die holders for external threading only, using round, split or acorn dies, or they may be furnished for use with both dies and taps in capacities from 2-56 to 1¼". The Tapper shown is threading ⅜-16 studs, to length of 1¼", at rate of 180 per hour. **T-2-10**



For the Tool Engineer's Service Bureau, see pages facing page 106.

Curve Drawing Instrument

A new and inexpensive device for drawing curves, called **INFINARC**, and announced by the *Cook Specialty Co.*, obtains the desired curve with specially tempered wire forms whose shape is altered by moving either or both of two adjustment screws along slots.



The tool is available with a 12 inch base and four interchangeable preformed wire curves with which it is possible to produce almost any shape desired, including reverse curves, to meet the needs of engineers, designers, draftsmen, architects, commercial artists, pattern and template makers. Made entirely of stainless steel, the instrument comes in an attractive, clear-lacquered wood instrument case. **T-2-11**

For the Tool Engineer's Service Bureau, see pages facing page 106.

*On Your Desk**
A LESSON IN TOOL ECONOMY & PERFORMANCE

HORIZONTAL TYPE — VERTICAL TYPE

SUPER EJECTOR* TYPE TOOLS

Consider these advantages of Super's Ejector type tool with inserted solid carbide bit compared with brazed or "point held" carbide: (1) Replace bit without replacing heat treated alloy steel holder. (2) Easy grinding in holder without bringing wheel in contact with steel permits economical use of diamond wheels. (3) Three times as many grinds to equal length of carbide. (4) Patented holding design eliminates stresses and strains on bit, permitting heavier cuts and less danger to carbide in rough and interrupted cuts. Carbide inserts on vertical tools 1½" long.

Write for our Bulletin on these tools.

STANDARD AND SPECIAL **SUPER** *Carbide Tools*

SUPER TOOL COMPANY
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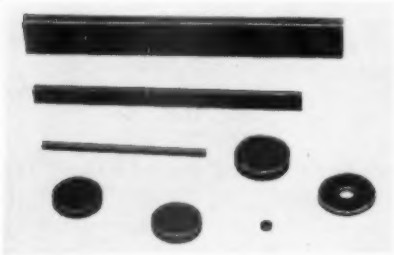
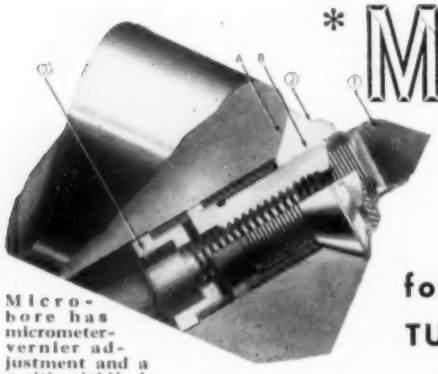
New Carbide Products

Three additional cemented carbide products—**SOLID DISCS, DISCS WITH HOLES,** and **SOLID STRIPS**—all of them adaptable to a wide range of applications, in a variety of industries, are now available as standard stock items from the *Carboloy Company, Inc.*



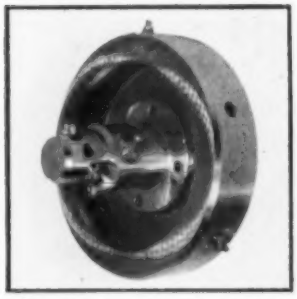
The solid discs are furnished in 10 sizes ranging from ⅛" diameter x 1/16" thick, up to 1" diameter x 3/16" thick. These discs are extensively used for wear-proof inserts in gages of various types as well as in micrometers and comparators; for tool-makers' flats; and for the wear-proofing of tools and equipment in general. The discs with holes range from ¼" O.D. x ⅛" I.D. x .030" thick, to 1¼" O.D. x 5/16" I.D. x .060" thick. These discs may be used for making small solid carbide slitting saws, and as nozzle inserts for sprayers or for other small orifices where undue wear is encountered. **T-2-12**



Microbore has micrometer-vernier adjustment and a positive rigid lock.

* MICROBORE by DeVlieg

A *NEW* BASIC TOOL for PRECISION BORING, TURNING AND FACING OPERATIONS!



Above: Example of cluster boring.

Below: For accurate adjustments to .0001" simply (1) loosen lock screw, (2) adjust collar to desired dial setting, (3) tighten lock screw.

FAST DEPENDABLE ADJUSTMENT TO .0001" ON DIAMETER

Microbore is a new cutting tool with means for making fast adjustments dependably accurate to .0001" (one ten-thousandth) on diameter. It can be applied anywhere in single or multiple stations for roughing or finishing where high accuracy, high performance and accurate relativity between machined surfaces is essential. Adjustment to its finest increment of setting is made in 10 seconds.

Microbore consists of: (1) the carbide tipped tool bit cartridge threaded through (2) a cone shaped adjusting nut having a graduated dial, seated and locked firmly in the bar by (3) lock screw and washer assembly. The double cone seated relation (a) between the adjusting nut and tool holder and (b) threaded relation between the cartridge and nut provides full rigid support of the tool up to the outer extremity of the graduated cone nut.

Its field of use is in production, precision tool and experimental work, for fast accurate setting and the elimination of cut and try methods.

Microbore may be applied in single or multiple stations for boring, turning and facing operations where such accuracy is obtained so fast as to practically eliminate machine down time for tool setting.

Control of precisely uniform form and shape of cutting edges is effected by grinding means that is a part of the Microbore system. Tools can be economically ground to precise requirements ready for installation and use. Write today for complete descriptive literature.

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Cutting tool sales engineering organizations required in a few open territories.

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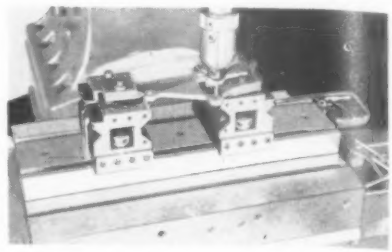
Work Holding Fixture

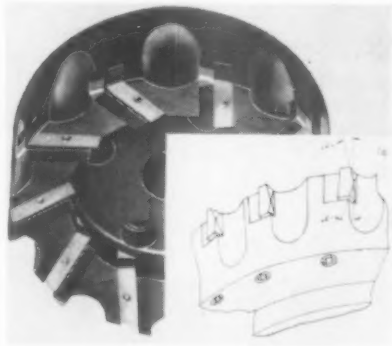
A **HOLDING FIXTURE,** by *Hanson & Company,* is adaptable to jig borers, jig grinders and similar machine used for precision tool and production work. As the fixture is permanently square and in line with the ways of the machine, this accuracy is imparted to the workpiece which, in turn, is aligned by the fixture for repetitive, accurate duplicating.



The sliding blocks are so designed that they can be used for an infinite variety of shapes and sizes within the range of the base plate; furthermore, the fixture can be used as a bench tool for checking and inspection. **T-2-13**

New Milling Cutter Grind

An improved grind, called the "**BI-AXIAL**", for making heavy side and face milling cuts with solid carbide insert blade cutters, has been developed by the *Super Tool Company* of Detroit. Tests, carried on over a period of time, indicate a great improvement over conventional negative angle on milling cutters.

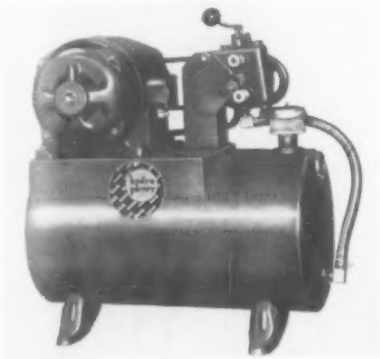


For example, cutters made with the new grind produced 12 to 15 forged die blocks (Brinell hardness 320 to 400) between grinds as against 5 to 7 blocks milled with cutters having conventional 7° negative radial and 7° negative axial rake angles. In both cases, operating conditions were identical:—the blocks, 22" long, were straddle milled with width of cut ½" to 9/16", depth of cut 2¼". Cutters ran at 320 s.f.m.; chip load .007" per tooth, table feed 11" per minute, consumed H.P. (for both cutters) was 42, idle H.P. 9.

The combination of negative radial and two negative axial rake angles have a "centering" effect on the cutter, stabilizing the pressure and eliminating flutter. As a result, an improved finish with longer cutter life is obtained. **T-2-14**

New Hydraulic Power Unit

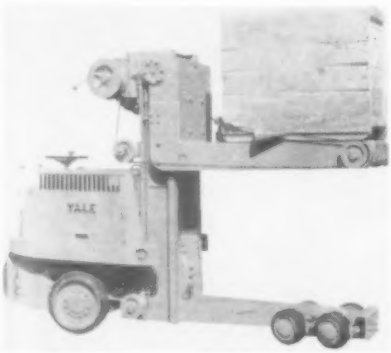
Dubbed the "Paul Bunyan, Jr.", a compact, portable hydraulic **POWER UNIT** capable of supplying three gallons per minute at 1000 psi, and announced by *Hydro-Power, Inc.*, can be quickly and easily turned to the operation of such equipment as hydraulic wheel pullers, shaft extractors, portable elevators, arbor presses, broaching tools, pipe benders, remote-control lifting jacks, chip balers, vises and clamping tools.



The unit includes in an integral structure a 17 gallon-storage tank with foot mountings, an electric motor, V-belt connected gear pump, and 4-way operating valve. Weighing approximately 290 pounds when supplied with oil, the assembly occupies a space 16⅛" wide by 28" long by 29" high. The unit, which is normally supplied with a 1½ h. p., 1800 rpm., 220 or 440-volt motor, but which can be used with a 2½ h. p., 1200 rpm. air-cooled gasoline engine for out-of-doors use, can be mounted on casters, or placed on a hand truck, for maximum portability. **T-2-15**

Electric Platform Truck

An electric high-light-platform **TRUCK**, by the *Yale & Towne Mfg. Co.*, will be found especially useful for placing dies and tools in presses and other machines, and also for loading and unloading trucks with varying tail-gate heights.

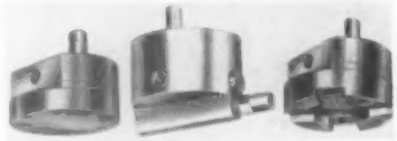


A novel feature of the unit is a pulley and cable arrangement for mechanically sliding goods on and off from adjacent levels, as indicated in the photo. When not required for special manipulation, the truck can be used as a conventional high-lift platform truck. **T-2-16**

Constant Feed Pump

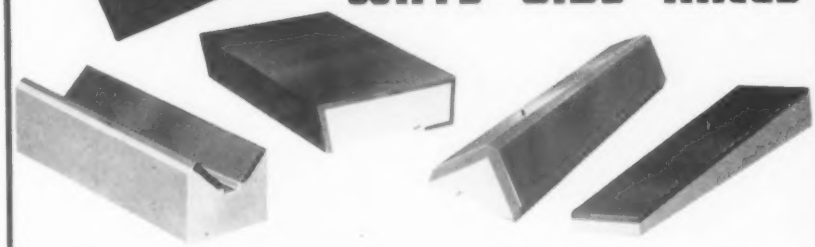
Among the newest products developed by *Bijur Lubricating Corporation*, is a high efficiency, constant feed **GEAR PUMP**, a small capacity unit that, because of its compact size (2½" diameter base) is readily adaptable to machines where space limitations exist. Because of small delivery (50 cc's per minute at 100 rpm) the correct quantity required by the machine can be fed to it without by-passing a high percentage of the output. The pump maintains a constant feed under high pressure during operation of the machine.

This gear pump is made in three types. The Universal (left) which can be mounted in any position, the direction of drive shaft rotation determining the direction of flow; the Reversible (center) which maintains flow in one direction only, regardless of change of drive shaft rotation during operation; and the Sump type (right) which is equipped with an integral fine mesh screen and may be mounted directly in the sump. **T-2-17**



For Tool Engineer's Service Bureau, see pages facing page 106.

It's OHIO for quality HARDENED WAYS • GIBS • RACES



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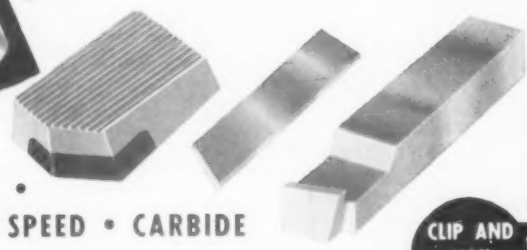

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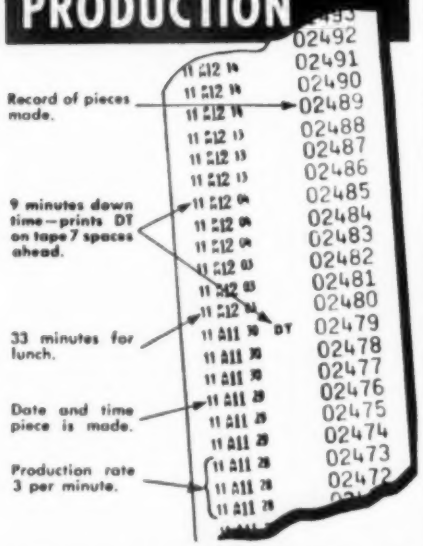

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See Exhibit at American Society of Tool Engineers Exhibition, space 1901-2002.

Multi-Purpose Conveyor

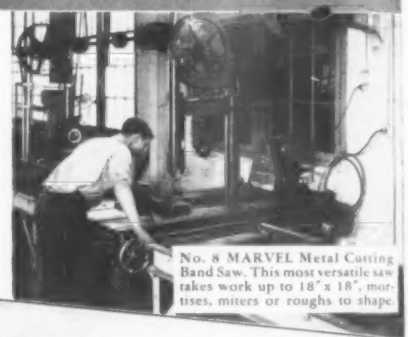
A new, standardized multi-purpose power belt conveyor—the **FLOOR-VEYOR, JR.**, by the *Rapids-Standard Company, Inc.*, is designed primarily for moving medium weight loads between floors or horizontally, as occasion demands. Built in multiple lengths of 2½ ft., up to 20 ft., the unit may be remodeled at any time by adding or removing standard sections and lengthening or shortening the belt.

Equipped with boot-type supports which provide height adjustment of both drive and take up pulleys, the conveyor can be operated with motor at either end, whether in elevated or horizontal position. Drive is with ⅓ or ¾ H.P. Motor with the larger motor, an 11 ft. unit, tipped at 25 degrees, will move a distributed load of 525 lbs., or 77.2 tons per hour. T-2-18

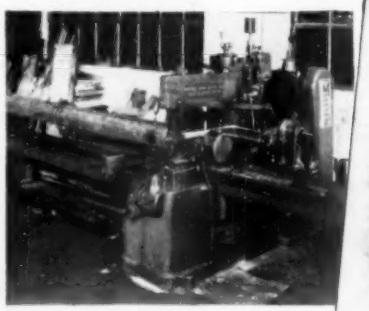
WHICH IS BETTER FOR YOU, HACK SAWS OR BAND SAWS ?

Reading Chain & Block Corporation found the answer by contacting the MARVEL field engineer. Only a MARVEL engineer could analyze this problem without bias because only MARVEL makes both hack saws and band saws. As a result, Reading bought three different types to most efficiently handle their metal sawing. A No. 6A machine for production cutting of identical pieces, a No. 4B machine for fast, accurate, miscellaneous cutting, and a No. 8 band saw machine for cutting of structurals, mitering, and other miscellaneous work.

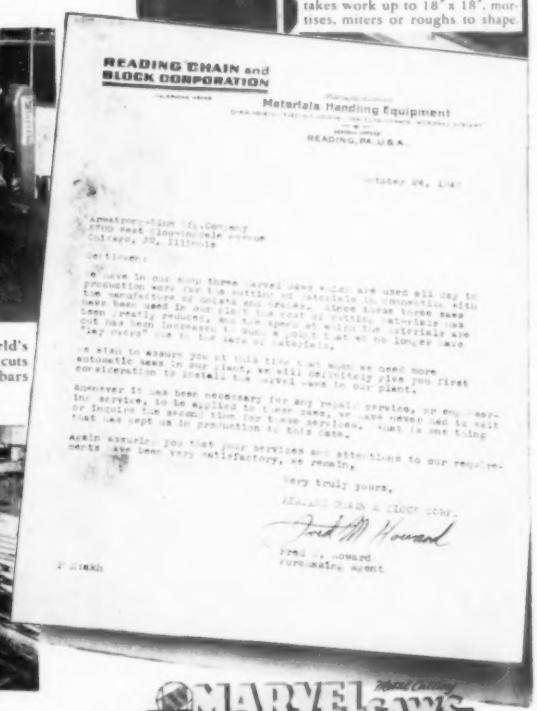
Whatever your metal sawing problem, there is among MARVEL'S 11 different series of sawing machines, a saw or saws that will exactly meet your needs. Your local MARVEL Engineer will gladly study your sawing problems, make recommendations and quote prices.

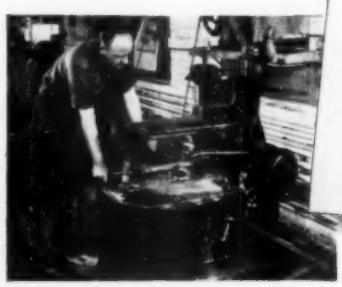


No. 8 MARVEL Metal Cutting Band Saw. This most versatile saw takes work up to 18" x 18", mortises, miters or roughs to shape.



No. 6A MARVEL Production Saw (world's fastest) automatically feeds, measures and cuts off identical pieces from nested or single bars up to 6" x 6" cross section.


READING CHAIN and BLOCK CORPORATION
Materials Handling Equipment
READING, PA. U.S.A.



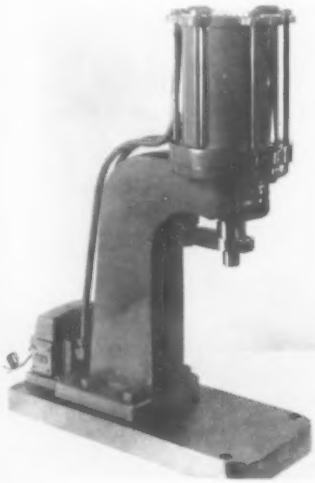
No. 4B MARVEL High Speed Saw is a moderate priced, very fast 6" x 6" capacity saw. Here it ideally meets the requirements of the maintenance department.

MARVEL SAWS
Metal Cutting
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"
5700 Bloomingdale Ave. Chicago 39, U.S.A.

Pneumatic Arbor Presses

Hannifin Corporation offers two new air operated **ARBOR PRESSES** said to be especially applicable to many common press fit assembling operations such as in the manufacture of electric motors, small tools and bearing parts. They are also suited to light stamping, working and die cutting operations.



Model M-1 is provided with a 4½" dia. x 4" stroke air cylinder and develops up to 1270 lbs. ram pressure with 80 lbs. line pressure. The larger M-2 has a 6½" cylinder, with 6" stroke, and delivers up to 2650 lbs. ram pressure. Both models feature a new push button controlled electric valve which eliminates valve operation and speeds up the operating cycle. **T-2-19**

Snagging Grinder

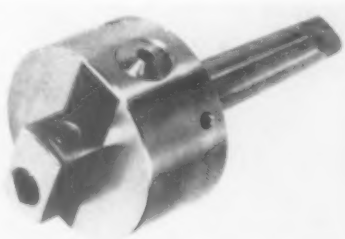
A 24-inch single end **SNAGGING GRINDER**, by the *Standard Electrical Tool Co.*, incorporates an interlocking speed control which prevents overspeeding of the grinding wheel. A hinged door guard, made of boiler plate and adjustable to compensate for wear, is an added safety feature. The shaft locks for change of wheels.

Equipment includes exhaust outlet, adjustable spark breaker, and safety glass eye shield. The tool is available for either right or left hand operation, for vitrified or resinoid bonded wheels and in sizes ranging from 10" to 30". **T-2-20**

Offset Boring Head

As announced by the *Flynn Mfg. Co.*, the Flynn No. 12 **OFFSET BORING HEAD** has been completely redesigned to provide a more compact body. This, together with an extension of the tool block nose, beyond the body, permits getting closer to the work as recessed or hard-to-reach jobs.

Other improvements include: wall of the tool grip has been increased $\frac{1}{8}$" per side, and length increased $\frac{1}{2}$"; ground bearing surfaces have been increased, at two points, by about 60%, and smoothness of operation has been increased by reducing the space between the ways, thus centralizing the micrometer adjusting screw. Also included is a more easily read micrometer screw, while hex screws, with one wrench fitting all holes, have replaced the square hole screws in the previous model. **T-2-21**



Follow the leaders of industry and replace slow, inaccurate, costly methods with the Centerless Lapping Machine.

With this Centerless Lapping Machine you obtain, without special operating skill, precision finishes of less than 2 micro inches on such materials as steel, glass, carbide, norbide and sapphire. No costly set-ups or special tools. Handles diameters .01 to 10.00". Automatic feed attachment available.

You'll find this unit ideal for lapping oversize bearings, lapping and sizing bearing races, bushings, shafts and cylinders; for lapping oversize gages; for salvaging worn gages by lapping to the next lower size. Send for Catalog 47.

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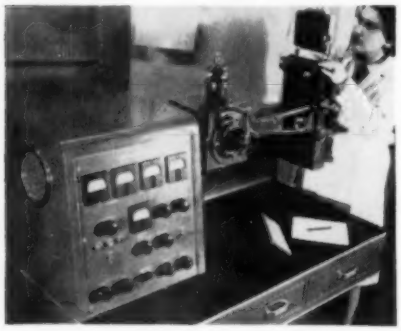
Electron Diffraction

Called an **ELECTRON DIFFRACTION INSTRUMENT** and designed to aid in surface analyses of metals, ceramics and plastics, a new research instrument opens up hitherto difficult problems associated with corrosion, catalysts, lubricants, pigments, surface deposits and graphite.



The new tool, which is a development of the General Engineering and Consulting Laboratory of *General Electric Company*, and announced by the company's Special Products Div'n, shows the crystal structure of surfaces and their specimens up to 500 Angstrom units. In that respect, it differs from X-ray diffraction, which analyzes thick specimens.

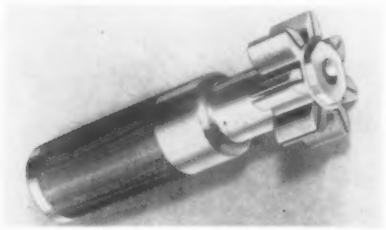
To operate the new tool, a beam of electrons is directed at the specimens being tested, and any resulting diffraction pattern is then photographed. The instrument consists of one unit containing a vacuum chamber with specimen manipulator, visual and photographic recording camera, electron gun and beam focusing elements, regulated high voltage power supply, and complete vacuum pumping equipment. As designed, the instrument can detect the first chemical changes even before they are visible under a microscope.

T-2-22

Adjustable Tooth Form

An adjustable **TOOTH FORM**, developed by the *M P Tool & Engineering Company*, is said by the makers to revolutionize gaging, checking and chucking for gears and splines.

The tooth, which is self centering, is described as having individual leftside and rightside profiles, extending through the full width of the gear, which may be rolled into or away from each other to vary tooth thickness or tooth space, the while retaining a full profile bearing. This feature may be considered as especially advantageous in difficult spline-locating problems involving diameter and face relations.

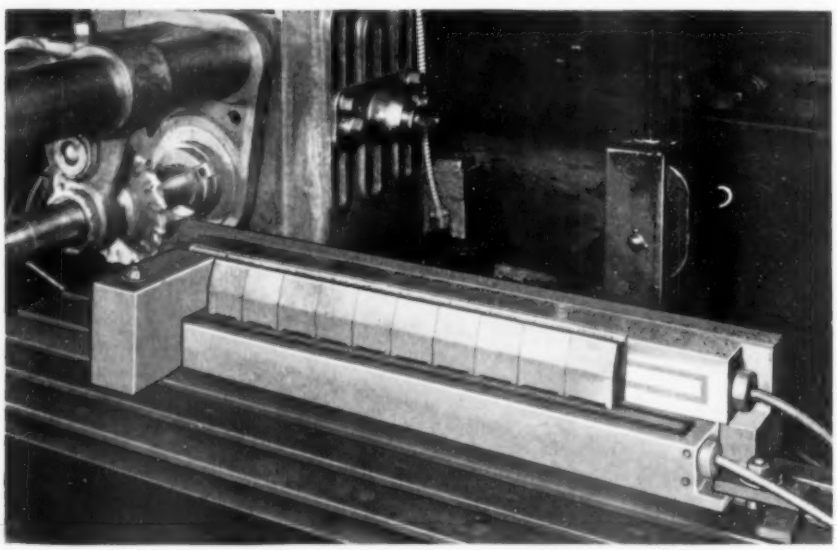


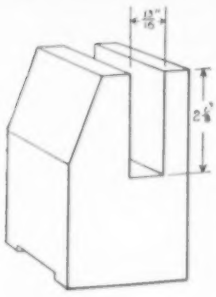
With the new tool, the part is checked from the internal teeth only, regardless of the tooth space broached or wear in the locator. This is made possible because a torsion spring holds the tooth profiles outward to a tooth thickness larger than any tooth space that is broached. The makers claim that, in conjunction with dial indicators, the new tool offers the only available means of visually indicating external and internal teeth. Hence, double checking with "go" and "no go" gages is eliminated since, in essence, the MP gage is a comparator.

Adapted to hole grinding or diamond boring, the MP gear ring gage becomes a self centering adjustable gear chuck. A rotary, locking motion is imparted through a draw bar, helical slot and cam follower—either mechanically, hydraulically, or pneumatically. The adjustable teeth of the chuck act as locators and grippers and remain correctly set, indefinitely, the while allowing considerable latitude in varying tooth thicknesses.

While the claims made for the new development are unusually broad, *The Tool Engineer* is informed that the makers invite, without direct thought of recompense, inquiries regarding "tough nuts" already cracked or foreseen. T-2-23

For Tool Engineer's Service Bureau see pages facing page 106.





Milling Costs Reduced with Power-Grip Holding

Unusual cost reductions are gained with Power-Grip Magnetic Holding on milling jobs like the one shown here. Ten pieces are held at a time, using two 36" Power-Grip Viking Chucks. Chucks are mounted so that pieces rest on one chuck with back of piece held against second chuck. End-stop is shown in front of cutter at left. Climb milling is done, with 8" diameter, 16 tooth, Carbide Cutter, at 175 R.P.M., 360 S.F.P.M., and feed at 10½" P.M. Material is cast iron. Cut is 13/16" wide by 2⅛" deep. Length of cut, through the ten pieces, is 25 inches.

Send prints and description of your work and receive, without obligation, complete proposal for Power-Grip Holding.

ROCKFORD MAGNETIC PRODUCTS CO., INC.
1304 18th Avenue, Rockford, Illinois

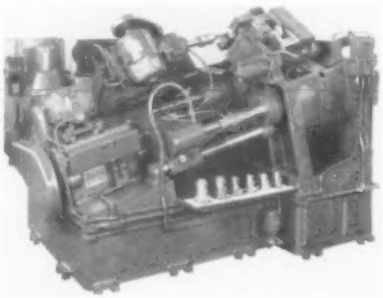
Send for This Booklet

ROCKFORD POWER-GRIP CHUCKS

Automatic Index Machine

A special purpose Single-End 5-Station Automatic Index **TRUNNION MACHINE**, by *LeMaire Tool & Manufacturing Company*, is designed for boring of hydraulic jack bodies.

Essentially, the machine consists of a rigid, fabricated base, which houses the coolant system and supports the trunnion index system, a LeMaire No. 5000 Twin Ram Hydraulic Drill Unit, with a 3-spindle boring head, mounted, at left, and a LeMaire No. 150 Master Lead Screw Tapping Unit, mounted on a hydraulically actuated sub-slide, mounted at Station 5. Units are powered with variable speed motors.



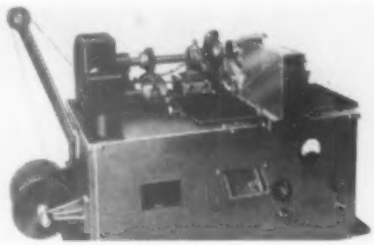
The trunnion is 5-station, automatic indexing, and the work holding fixtures are hydraulically operated, self-centering vise type, clamped and unclamped by air cylinders. To eliminate chip pockets, the parts are machined in angular positions, and ample cooling flows through the center of all cutting tools and taps.

Operation sequence is as follows: Sta. 1, load and unload; Sta. 2, rough bore 2-7/16" dia., 1/16 x 45° ch., rough face 4½" dia., rough bore 4 3/16" .002" .000" c' bore; Sta. 3, finish face 4½" dia.; Sta. 4, finish bore 2-7/16 dia. and finish bore 4.1875 .002"-.000", c' bore; and Sta. 5, tap two ½" -20 holes. Production is at the rate of 150 pieces per hour. **T-2-23**

Automatic Welder

A new **WELDING MACHINE**, developed by the *Tweezer-Weld Corporation*, for the welding and shaping of light, small parts difficult to process manually, welds automatically by means of an electronic welding and timing device. Assemblies or small parts are fed to a turret, either by hand or automatically from a hopper, and—before or after welding—components can be shaped so that the welded parts, when they leave the machine, are ready for assembly into the final product.

The equipment is said to be particularly effective in attaching light wire from a spool to parts fed automatically, and one of the chief uses is the welding of tabs to radio tube cathodes. The machine can produce approximately 3,000 cathode assemblies per hour, without the use of an arbor and will handle round and flat cathodes from .020" x .006". **T-2-24**



COPY!

"Let your Light so Shine"

This Free Lance Writer, Planner and Editor of long experience, member of ASTE, could prepare your Manual, Catalog or Promotional Specifications and probably save you time and money —your office or mine.

C. F. WORFOLK

ALGONAC, MICH.

(Algonac is near Detroit)

SHELDON

T-S56 PRECISION LATHES

Why wear out big equipment on little jobs . . .

It costs money to operate big lathes—ties up costly equipment, takes more expensive tooling, more power, more floor space, requires a more experienced operator. It's just good business to have smaller, handier, faster lathes like the SHELDON T-S56 for much of your work, and save the difference in operating cost.

The SHELDON T-S56 Precision Lathe has 11¼" Swing, 1" Collet Capacity (large 1⅜" hole thru spindle) and is made permanently accurate with Zero Precision taper roller bearings.

Write for Bulletin

SHELDON MACHINE CO. Inc.

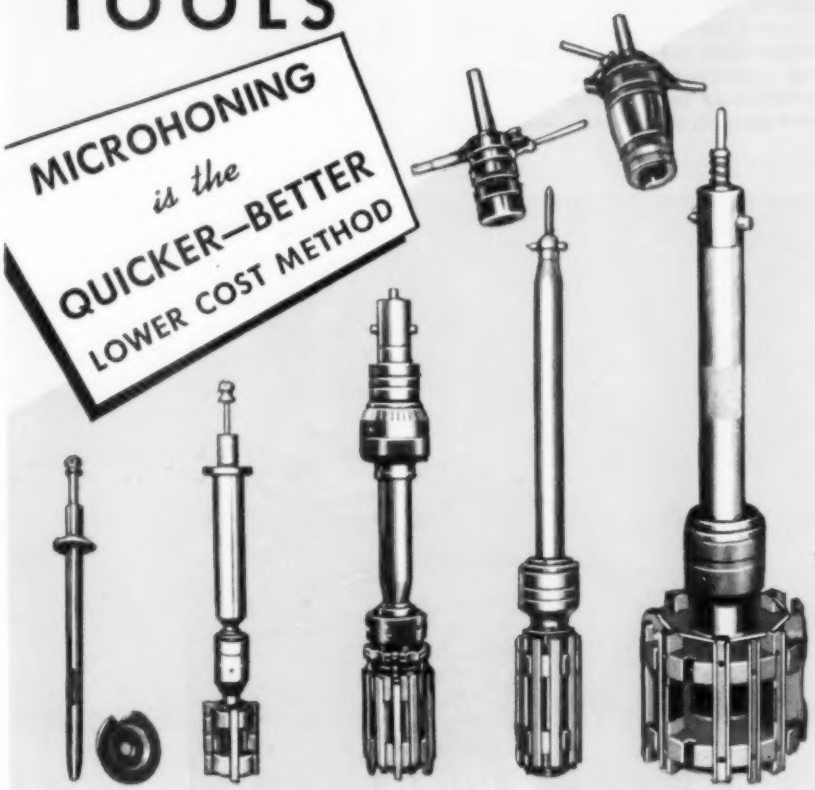
Manufacturers of Sheldon Precision Lathes • Milling Machines • Shapers

4229 N. KNOX AVENUE • CHICAGO 41, ILLINOIS, U. S. A.

For Round and Straight Bores Uniformly Sized and Finished

MICROHONING* TOOLS

MICROHONING *is the* QUICKER—BETTER LOWER COST METHOD



Micromold* Tool and Microsize* Ring | General Purpose Microhoning Tools | Hydraulic Tools | Brake-Type Tools and Adjusting Head | Hydrobrake* Tools with Adjusting Head

MICROMATIC MICROHONING TOOLS

in the range of bore diameter sizes from ¼" to 42", and up to 75 feet long, correct error and generate final roundness and straightness within limits of .0001" to .0003", either by AUTOMATIC or operator control—remove up to .080" stock at rates up to .012" per minute on diameter—and any desired type of surface finish. They are designed and constructed to meet the needs of economical precision production. We can mail further information.

*Trademark Reg. U.S. Patent Office.

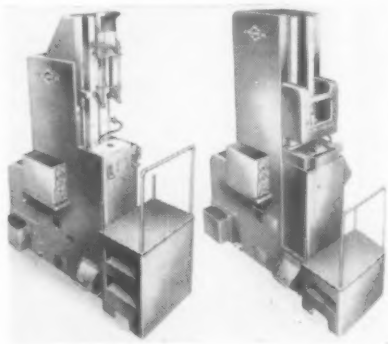
MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVE. • DETROIT 4, MICHIGAN

Los Angeles, Calif. • Houston, Texas • Rockford, Ill. • Guilford, Conn. • Brantford, Ont., Can.

New Broaching Machines

Two new lines of **BROACHING MACHINES**, recently announced by the *Colonial Broach Company*, include a Pull-down Machine, shown at left, and a Pull-Up Machine, illustrated at right. Both lines are available in 5 and 10 ton models and feature improved design and control for increased production and easier maintenance.



The new machines have an entirely new hydraulic system layout. Hydraulic pumps are located outside of the machine housing, thus immediately accessible for adjustments, inspection or service. Also, a new air circulating system, for the motors and hydraulic system, provides maximum cooling and permits sustained high-peak loads.

All other hydraulic and electrical controls and applicances are accessible for inspection. Filters, for example, may be inspected and cleaned without draining the oil or stopping the machine.

T-2-26

Non-Synchronous Control

A new Non-Synchronous **CONTROL** (NEMA TYPE N2), suitable for mounting on the side of resistance welders and designed for foot, air, motor and hydraulically operated spot, projection, butt and seam welders, is announced by the *Taylor-Winfield Corporation*.

The makers claim accurate setting of timing, made possible by (1) timing dials graduated with wide range at short time settings; (2) timing dials graduated on cycles for each frequency (60, 50 and 25 per second); and (3) timers for pulsation welding have the impulse timer dial reading directly in the number of impulses desired. No adding of heat and cool times by the operator. While designed for use with T-W welders, the control may be adapted to other welders, Taylor-Winfield assuming entire responsibility for installation, service and renewal parts. T-2-27

See insert facing page 106 for Tool Engineer's Service Bureau.

New Ames Hardness Tester

A 4" capacity portable **HARDNESS TESTER**, weighing slightly over three pounds and reading directly in the Rockwell hardness scales is now offered by *Ames Precision Machine Works* for those who require a Tester larger than the previous 1" capacity Model 1. Rounds and flats, both hard and soft, from very thin up to four inches are tested quickly and accurately with the new Model 4, which employs a diamond penetrator for testing hardened steel. Ball penetrators are used for testing soft materials, as specified in the Rockwell chart.

The frame, shaped like that of an ordinary 4" micrometer, springs slightly when pressures are applied to the penetrators by turning the handwheel. A lever, extending across the front of the frame, actuates the dial indicator—which has graduation lines to show pressures of 60, 100, and 150 kilograms—when pressures are applied and released by turning the handwheel.

T-2-28

Automatic Disintegrator

An **AUTOMATIC DISINTEGRATOR**, said to remove studs, taps, drills or other broken tools without distortion, is announced by *Ansaldi Tool & Engineering Co.* Electrodes are used as agents to remove the obstruction, and broken taps from No. 2 to 1" are easily removed—for example, a 1" tap may be disintegrated in about 8 minutes.

T-2-29

WENDT SONIS

Line of Reamers IS COMPLETE

CARBIDE FULL LENGTH FLUTE REAMERS STRAIGHT OR TAPER SHANK

LEFT HAND SPIRAL REAMERS

RIGHT HAND SPIRAL REAMERS

CARBIDE TIPPED REAMERS STRAIGHT OR TAPER SHANK

JOBBER REAMERS STRAIGHT OR TAPER SHANK

STUB SCREW MACHINE REAMERS

SHELL REAMERS

- COMPLETE RANGE OF SIZES
- WIDE SELECTION OF STYLES
- HARDENED STEEL SHANKS
- ADVANCED DESIGNS

The W-S line of reamers is so complete that they can meet practically all your reaming requirements. For example, W-S Straight Shank Reamers style SSR are available from stock in 37 sizes ranging from 1/8" to 1 1/2". Similar ranges of sizes are available in 12 other types of standard reamers. Quick delivery can be obtained on standard reamers with special diameters and tolerances. "Engineered for the Job" design increases production and saves on tool costs. You get longer wear—greater accuracy when you select Wendt-Sonis Reamers for your requirements.

Free! W-S SPEED AND FEED CALCULATOR

Quickly figures feed and speeds on reaming and other operations. Write WENDT-SONIS COMPANY, Hannibal, Missouri, —580 North Prairie Ave., Hawthorne, Calif. — 1361 West Lake St., Chicago, Ill.

WENDT SONIS

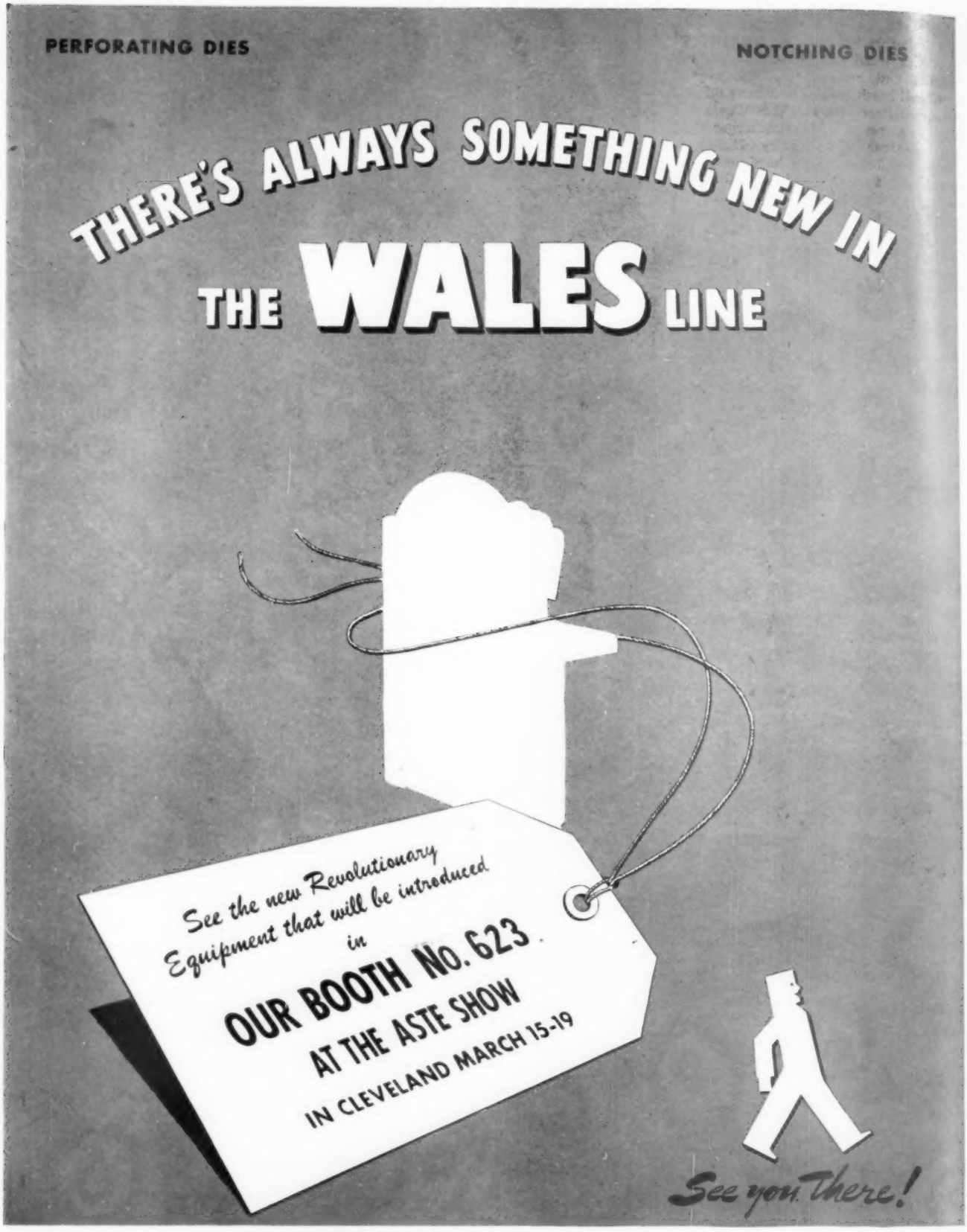
CARBIDE TIPPED CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • SPECIAL BITS

PERFORATING DIES

NOTCHING DIES

THERE'S ALWAYS SOMETHING NEW IN THE WALES LINE


See the new Revolutionary Equipment that will be introduced in
OUR BOOTH No. 623
AT THE ASTE SHOW
IN CLEVELAND MARCH 15-19
See you there!

WALES-STRIPPIT CORPORATION

GEORGE F. WALES, President

NORTH TONAWANDA, N.Y.

(BETWEEN BUFFALO AND NIAGARA FALLS)

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONTARIO

Specialists in Punching and Notching Equipment

A BUYING GUIDE FOR ABRASIVES

ABRASIVE PROBLEM:

Is there anything NEW on Identifying, Specifying and Packaging Coated Abrasives?

ANSWER BY

CARBORUNDUM
TRADE MARK

The Carborundum Company has developed an entirely new and more convenient method of packaging coated abrasives. Based on a careful analysis of requirements and problems of both users and distributors, it facilitates use, handling, shipping and stocking of coated abrasives.

Under this new system, sturdy packages contain "decimal" quantities of 25, 50 or 100 sheets. Cartons replace paper wrappings. Standard units are emphasized. Products are clearly identified by their end-use name on labels and backing. Ordering is expedited. Pricing and inventory are simplified. Handling is easier. Cardboard sleeves protect against curling and tearing

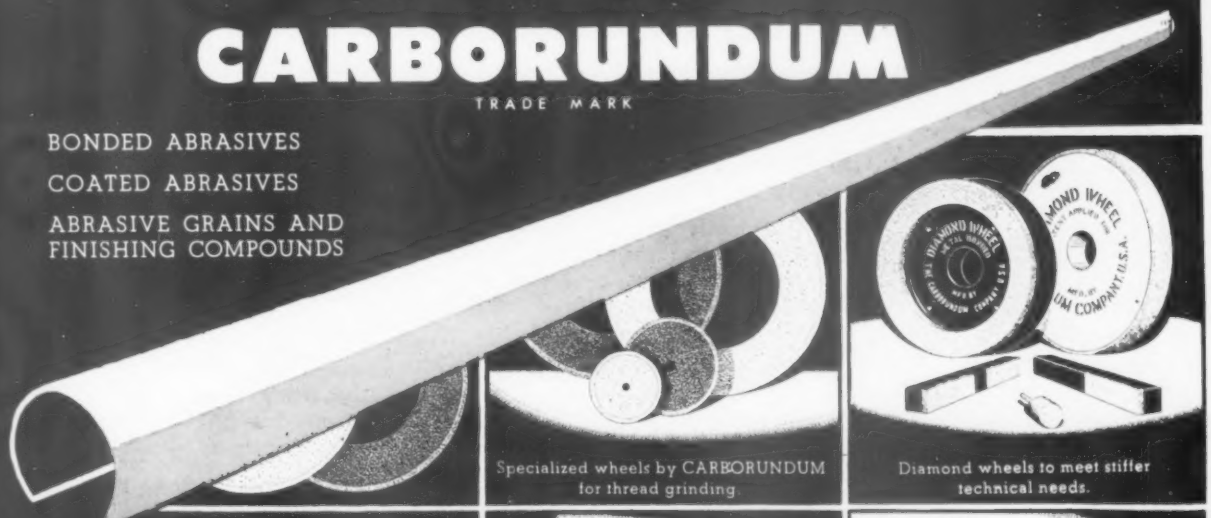
This interest in the problems of our customers is amply repaid in the increasing preference for products by CARBORUNDUM. The Carborundum Company, Niagara Falls, New York.

CARBORUNDUM
TRADE MARK

BONDED ABRASIVES

COATED ABRASIVES

ABRASIVE GRAINS AND FINISHING COMPOUNDS



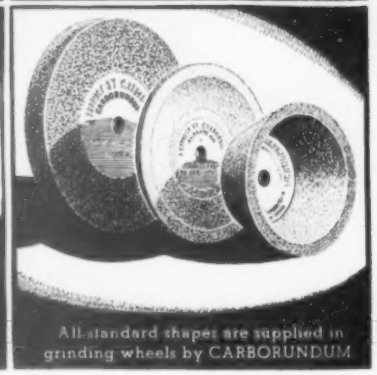
Specialized wheels by CARBORUNDUM for thread grinding.

Diamond wheels to meet stiffer technical needs.

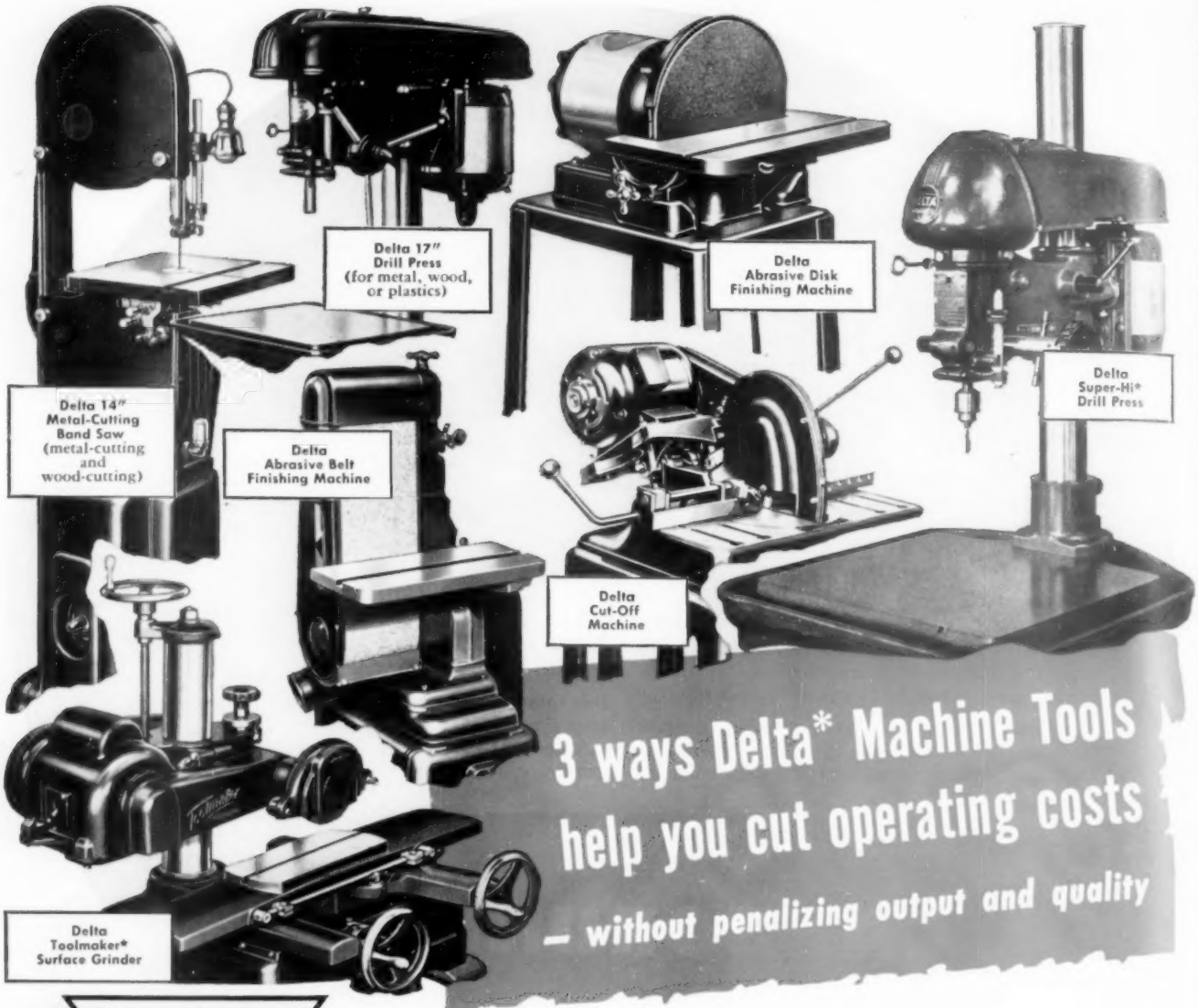
"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

Cool-cutting green grit wheels for cemented carbide.

A coated abrasive for every sanding and finishing condition



All standard shapes are supplied in grinding wheels by CARBORUNDUM


Delta 17" Drill Press (for metal, wood, or plastics)
Delta Abrasive Disk Finishing Machine
Delta Super-Hi* Drill Press
Delta 14" Metal-Cutting Band Saw (metal-cutting and wood-cutting)
Delta Abrasive Belt Finishing Machine
Delta Cut-Off Machine
Delta Toolmaker* Surface Grinder

3 ways Delta* Machine Tools help you cut operating costs

— without penalizing output and quality

DELTA
MILWAUKEE
®

BY fully utilizing the portability and compactness of versatile Delta Machine Tools, you cut down your capital investment — and reduce your fixed overhead.

With low-cost, stock-model Delta components, you can:

1. Build high-production, special-purpose machines that can be readily converted to other uses, when changing conditions warrant; thus you save the heavy expense of buying costly special tools of limited usefulness;
2. Modernize obsolete machines, by replacing worn units;
3. Quickly revise or supplement production-line layouts for more efficient operation.

There is no compromise with quality, to bring you Delta's savings in cost, weight, and space; they result from advanced design and from quantity production of standard models.

Perhaps a study of Delta Machine Tools may suggest ways to help keep your costs down, even in the face of high wages and expensive raw materials. Discuss this with your Delta distributor. He is listed under "Tools" in the classified section of your telephone directory. Look for his name.

DELTA MANUFACTURING DIVISION
ROCKWELL MANUFACTURING COMPANY
MILWAUKEE 1, WISCONSIN
General Sales Office • 6 NORTH MICHIGAN AVENUE, CHICAGO 2, ILLINOIS

Mail coupon for free bulletins on Delta metal-working machines:

Bulletin A-14-3 pictures and describes Delta Super-Hi* Drill Presses, for small-hole work from .025" dia. to ¼".

Bulletin A-17 pictures and describes Delta 17-inch Drill Presses.

Bulletin A-20 pictures and describes Delta Cut-Off Machines.

Bulletin A-23 pictures and describes Delta Toolmaker* Surface Grinder, Chip-Breaker Grinder, Tool and Cutter Grinder.

Bulletin A-28 pictures and describes the Delta 14-inch Metal-Cutting Band Saw.

Bulletin A-31 pictures and describes Delta Abrasive Finishing Machines (belt and disk types).

*Trade Mark Reg. U.S. Pat. Off.

Tear out coupon and mail today!

DELTA MANUFACTURING DIVISION
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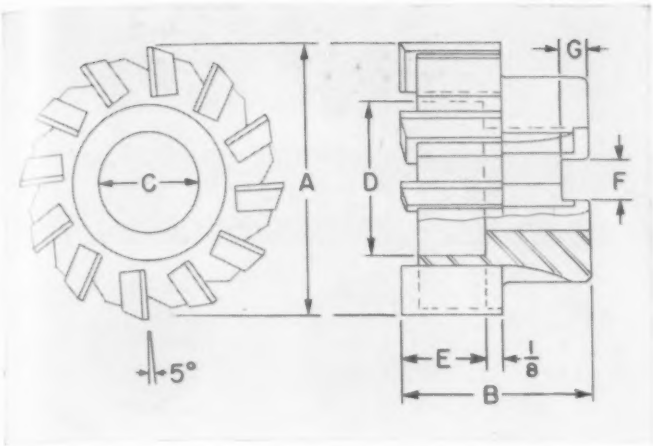
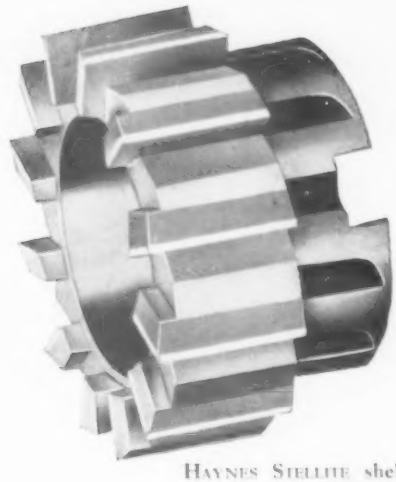
M-29





HAYNES STELLITE shell end mills consists of HAYNES STELLITE cobalt-base alloy blades brazed into a tough alloy steel body.

Mill it Faster with HAYNES STELLITE Milling Cutters!

HAYNES STELLITE milling cutters with brazed-in blades are designed especially for faster milling. End mills, such as the one illustrated above, are operated on cast iron, malleable iron, and semisteel, with a chip load of 0.010 to 0.015 in. per tooth. They are used on mild steel with a load of 0.005 to 0.010 in. per tooth. On non-ferrous metals, and on plastics, hard rubber or fiber, the chip load is often increased to 0.030 inch.

These high-production tools can operate at surface speeds of 300 ft. per min. on cast and malleable irons . . . 600 ft. per min. on brass . . . 1,200 ft. per min. on aluminum.

Diameter (A)	Thickness (B)	Hole (C)	Counterbore		Drive Slot		Size of Blades	No. of Teeth
			(D)	(E)	(F)	(G)		
1¼	1	0.500	11/16	3/8	0.260	5/32	3/16 x 1/4 x 1/2	8
1½	1⅛	0.500	3/4	1/2	0.260	5/32	3/16 x 5/16 x 5/8	10
1¾	1¼	0.750	11/16	1/2	0.322	3/16	3/16 x 5/16 x 5/8	10
2	1⅜	0.750	1⅛	5/8	0.322	3/16	3/16 x 3/8 x 3/4	12
2¼	1½	1.000	1⅜	3/4	0.385	7/32	3/16 x 3/8 x 7/8	12
2½	1⅝	1.000	1⅜	7/8	0.385	7/32	3/16 x 1/2 x 1	14
2¾	1⅝	1.000	1⅝	7/8	0.385	7/32	3/16 x 1/2 x 1	14
3	1¾	1.250	1⅞	1	0.510	9/32	1/4 x 1/2 x 1⅛	14
3½	1⅞	1.250	2⅛	1⅛	0.510	9/32	1/4 x 5/8 x 1¼	16
4	2¼	1.500	2½	1¼	0.635	3/8	1/4 x 5/8 x 1⅜	18

Send For Free Booklet

For more information on HAYNES STELLITE high-production cutting tools not only for milling, but also for turning, boring, facing, and other operations, write for the booklet, "HAYNES STELLITE Metal-Cutting Tools," Form 5401.

Sizes other than those shown in the table can be supplied, and standard blades are also available for inserted blade cutters.

HAYNES alloys
TRADE-MARK

Haynes Stellite Company

Unit of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Chicago — Cleveland — Detroit — Houston — Los Angeles — New York — San Francisco — Tulsa

The registered trade-marks "Haynes" and "Haynes Stellite" distinguish products of Haynes Stellite Company.

Sunnen Honing

Assures Tool Room Precision

Hardened steel ring gauge —finished to an accuracy of .000025" for roundness and straightness.

Typical Examples

Sunnen precision honing to a highly polished finish increases wearing quality of these hardened steel drill jig bushings.

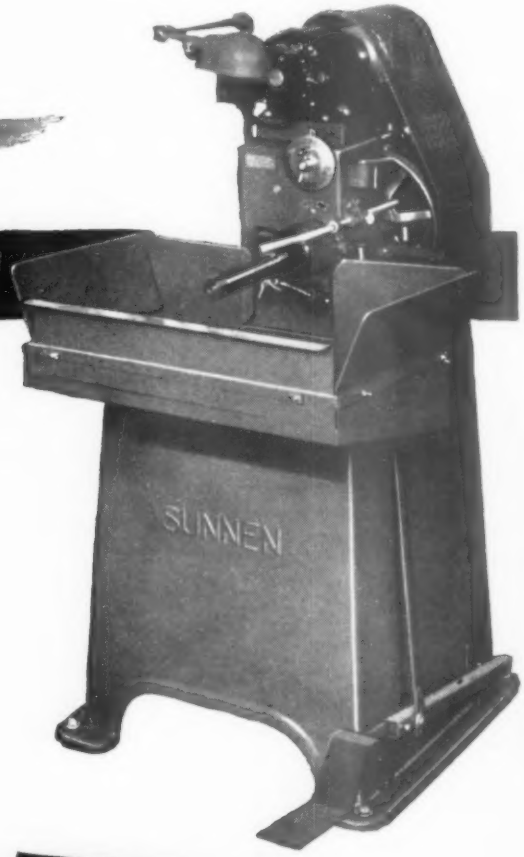
Shell Loading Die.

Rubber Eraser Extrusion Die "Tripled life of extrusion dies."

Drawing and blanking die "saves time in producing smooth base metal finish."

Plus

Great Saving of Time



The Sunnen Precision Honing Machine produces a straight round hole, free from bell-mouth and taper, in any steel, carbide, cast iron, bronze—in fact, any metal except lead or babbitt.

Accuracy within .0001" is guaranteed—*but this machine is being used to hold tolerances as close as .000025" and to produce a 2 micro-inch finish in hardened steel.*

Sunnen Precision Honing is many times faster than lapping. Many users are honing dies and fixtures in 20 to 30% of the time formerly spent on lapping. New developments in abrasives permit producing any degree of surface finish desired.

For fitting dowel pins and ejector pins, for finishing ring gauges, extrusion dies, etc., the Sunnen Precision Honing Machine provides the ideal method of producing precision finishes in the shortest time.

Write for bulletin giving complete information — or we'll gladly send a Sunnen engineer to your plant.

SUNNEN PRODUCTS COMPANY
7956 Manchester Ave., St. Louis 17, Mo.
Canadian Factory: Chatham, Ontario

SUNNEN
TRADE MARK REG U S PAT OFF - MARCA REGISTRADA

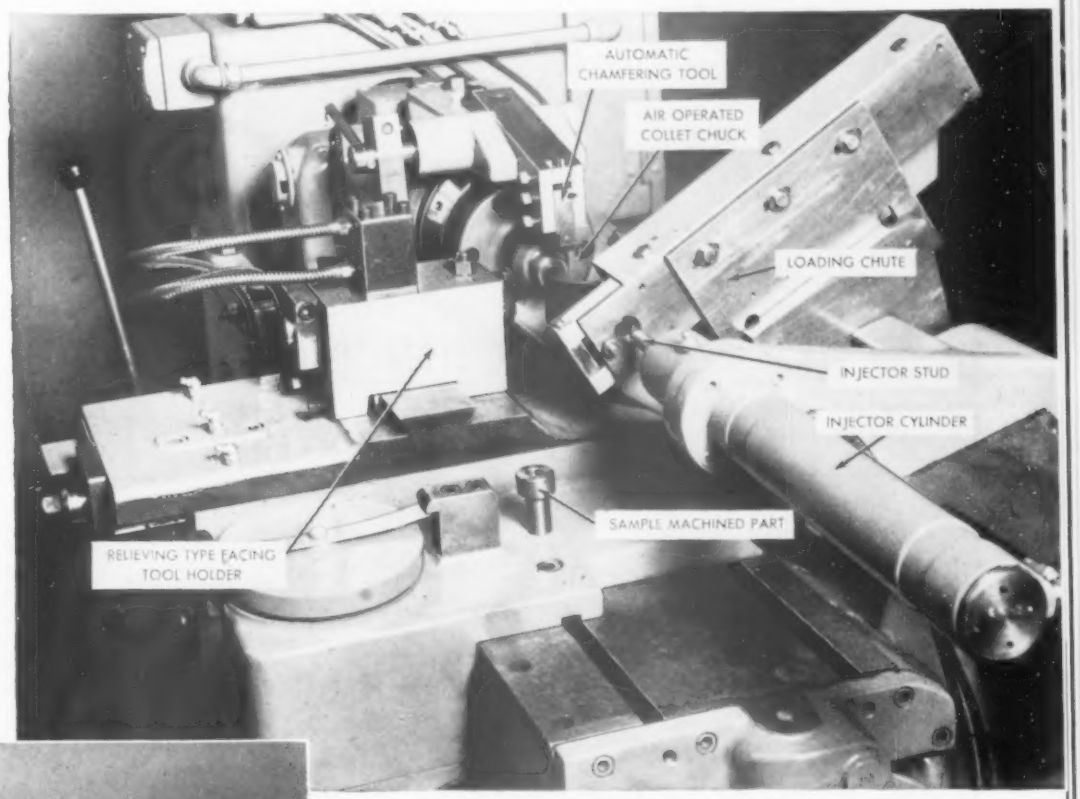
Precision Honing Machine

Sizes and Finishes All Internal Diameters—.120" to 2.625".

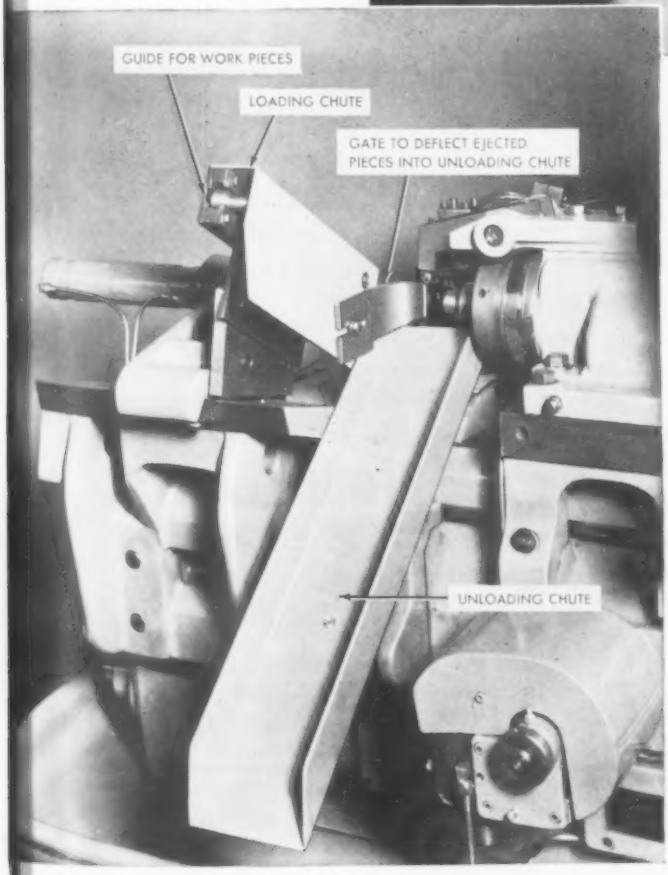
299

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. **"THE Lo-swing PEOPLE"** SENECA FALLS, NEW YORK



Automatic Loading enables the machine to produce to its full mechanical efficiency by eliminating the human equation.



AUTOMATICALLY LOADED IMP LATHES CUT MANUFACTURING COSTS

Problem: To finish face and chamfer bore of pump gear true with bearing diameter.

Solution: The Lo-swing IMP Lathe selected for this job was fitted with an injector type automatic loader which provides a very fast, completely automatic cycle, entirely eliminating hand loading and assuring a constant flow of machined parts at exceptionally low cost per piece.

The partially machined pump gears are placed in a loader chute and fed by gravity to the loader injector arm which picks up and places the part in an air operated collet chuck.

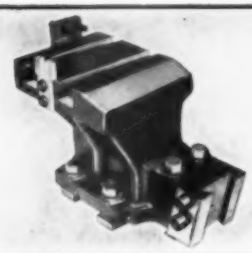
The facing operation is accomplished with a relieving type tool block mounted on the front slide. The tool is automatically relieved during the return stroke to avoid spiral tool marks. The chamfering operation of the bore is made with a swinging type tool block mounted on the headstock and automatically operated with a cam mechanism working in conjunction with the front cross slide.

On completion of the machining operation the pump gear is automatically ejected by a plunger located in the bore of the spindle after which the cycle is repeated.

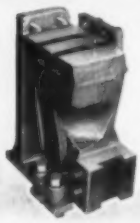
Lo-swing Lathes fitted with Automatic Loaders are usually grouped together in series of two or more, since one operator can easily keep the loading chutes on several machines filled with pieces.

Seneca Falls engineers are always at your disposal to help find cost cutting solutions for your turning problems.

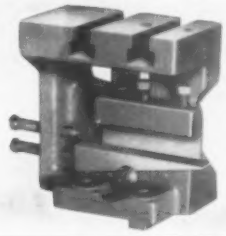
PRODUCTION COSTS ARE LOWER WITH Lo-swing



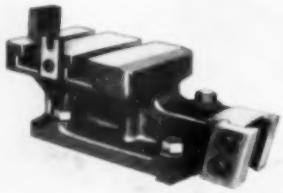
Double deck dovetail form tool holder for Acme-Gridley.



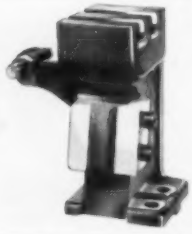
Double deck dovetail form tool holder for F or G Gridley.



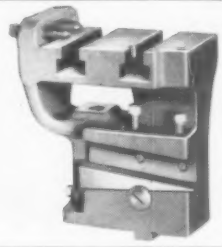
Double deck flat form tool holder for front position on F or G Gridley.



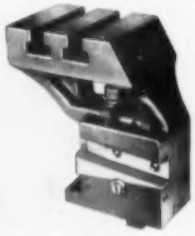
Double deck dovetail form tool holder for Acme-Gridley.



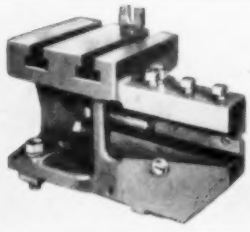
4th position double deck dovetail form tool holder with 3rd position cut-off for F or G Gridley.



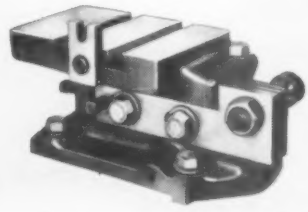
Double deck flat form and cut-off tool holder for F or G Gridley.



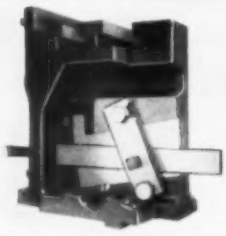
Double deck cut-off and shave tool holder for F or G Gridley.



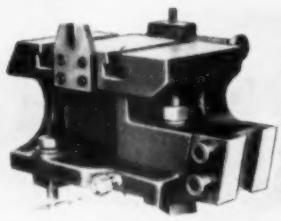
Double deck flat form tool holder for all Acme-Gridley.



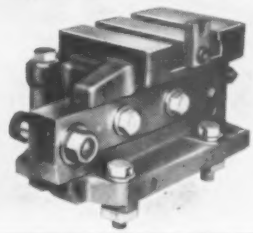
Double deck circular form tool holder for Gridley and Acme-Gridley.



Double deck flat form tool holder for front position on 1¾ to 2⅝ inch F or G Gridley.



Double deck dovetail form tool holder for Acme C Automatics.



Double deck circular form tool holder for Gridley and Acme-Gridley.

SLITTER'S TOOL HOLDERS *MEET ALL YOUR REQUIREMENTS*

The double deck tool holders shown here are but a few of the 400 items which comprise the SLITTER line of standard automatic screw machine tool holders. Included in our complete line are flat form, dovetail, and circular forming tool holders for C Acme, F or G Gridley, Acme-Gridley, New Britain Gridley, Greenlee, and Cone automatics. The selection is so wide and varied that you will find our standard holders capable of meeting 90% of all your requirements.

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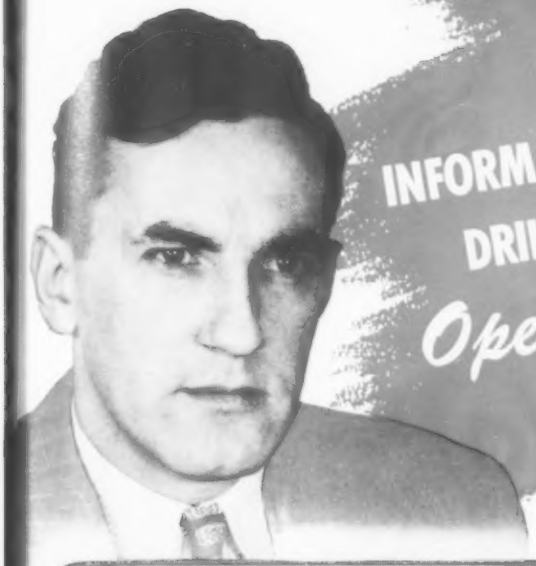

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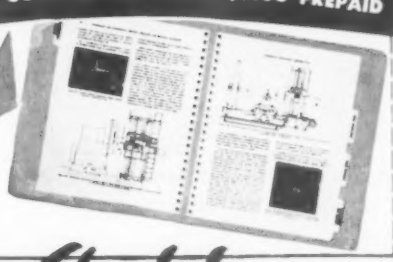

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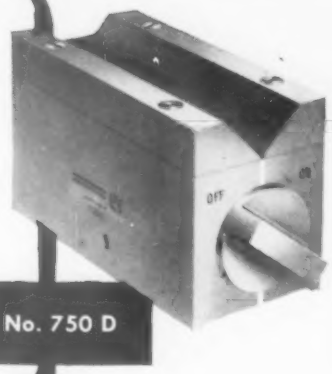

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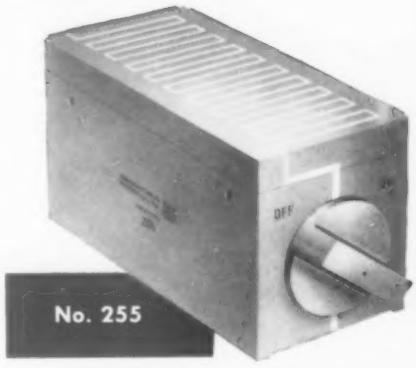

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No. 255 Magnetic Chuck for holding small or thin work in toolmaking and manufacturing or for inspection purposes. Small pieces held firmly for grinding on closely divided top surface. Working surface, 2 7/16" x 5¼".

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YES . . . in a recent comparative performance test, 150 Aber "Curved Tooth" milling cutters *out-performed* 425 conventional type milling cutters — a 2½ to 1 increase at NO EXTRA COST!

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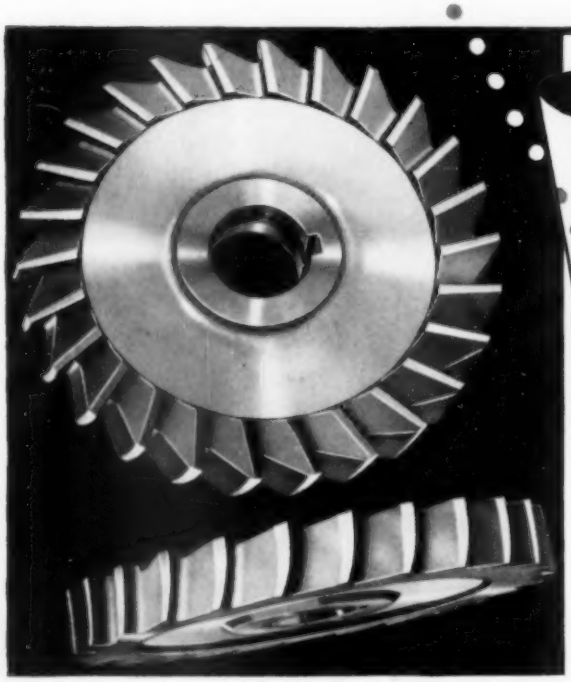

A TYPICAL ABER "CURVED TOOTH" PERFORMANCE

OPERATION: Milling lugs on plate. Slotting and side milling parallel sides.

MACHINE: Cincinatti 3-Spindle Mill.

TOOL SETUP: (1) R. H. and L. H. Shear Side Milling Cutter.
(1) R. H. Half Side Milling Cutter.
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Feed: 10-1 2"

PERFORMANCE: 16-1 2 hours between grinds. Best previous practice with conventional, straight tooth H. S. S. milling cutters was 6-1 2 hours between grinds.

KEEP UP TO DATE with tool design progress. Write today for more detailed information on the ABER line of "Curved Tooth" milling cutters.

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better gears

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Shown at right are a few pages from this new book, "Design of Gear Teeth." Detailed drawings appear throughout the text for graphic explanation of the theories and practices involved.

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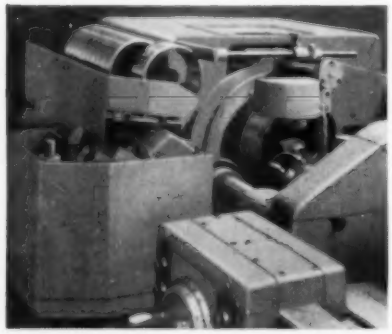
Completely Automatic GRINDING!

● Automatic loading and positioning of parts in workhead of new Model 281 Centerless.



● Model 381 Centerless workhead with new automatic loading device for large work.

On a brand new line of Heald Centerless Internals

There's no comparing these new Heald Centerless Internals with any others. From base to bridge, they're *completely new*—completely different in design and performance. And they handle a wide range of cylindrical work—wider than ever before.

Peg your production rates high. For these are high-capacity, high-production, high-precision machines . . . each with continuous and completely automatic cycle (loading through unloading) . . . each grinding "the centerless way" for uniform wall thickness, perfect concentricity, and errorless reloading. They offer you:

GREATER ACCURACY AND PRODUCTION. Base and wheelslide more rigid . . . feeds and table action uniformly constant throughout the day, remaining so without adjustment . . . wheelhead and work rotation smoother.

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MINIMUM MAINTENANCE. Valves mounted in front for easy accessibility . . . steel hydraulic tubing means leak-proof joints . . . electrical controls grouped at rear . . . isolated power unit rolls out from base.

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★ Deep-hardening for high pressures.
★ High wear-resistance for long runs.
★ Produces a clean, highly-polished surface.

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NORMAL WORKING HARDNESS: 58 TO 62 ROCKWELL C

BETHLEHEM STEEL

Specify BTR for machine-cut molds and dies. You'll get long runs and top-quality finishes with this easy-machining, high-strength tool steel.

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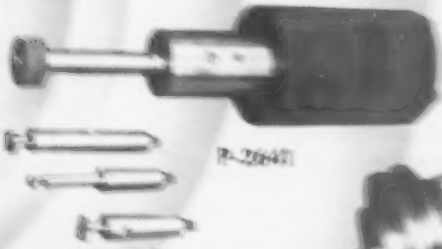
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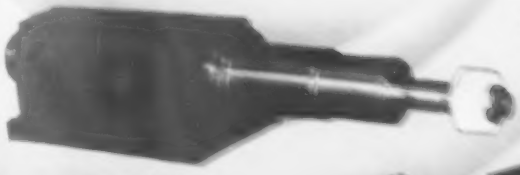
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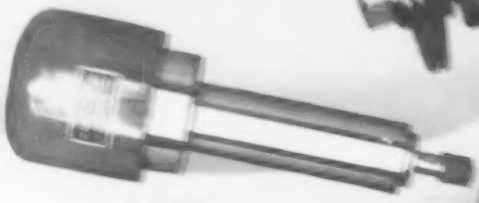
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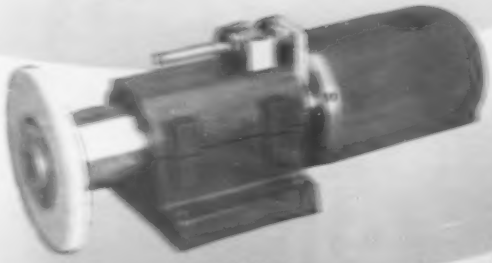
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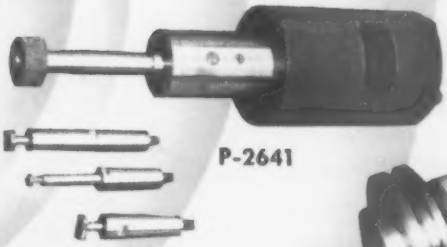
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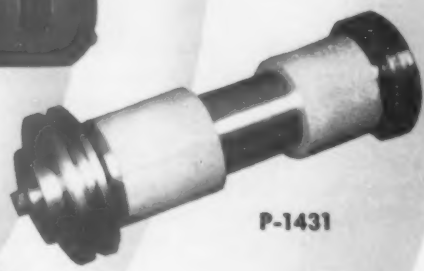
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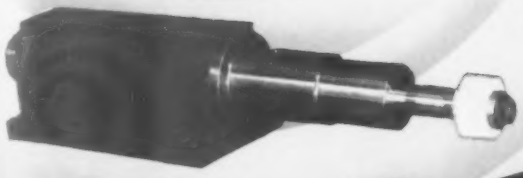
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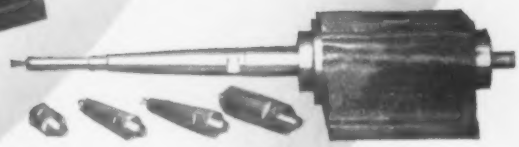
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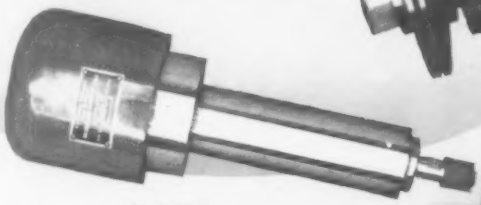
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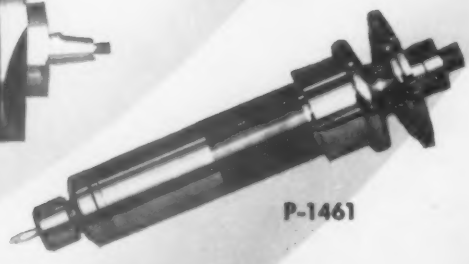
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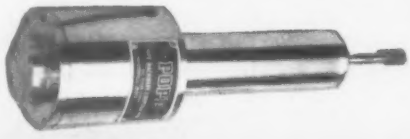
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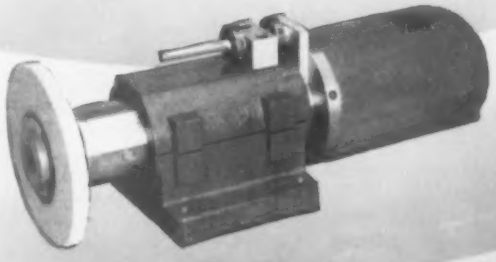
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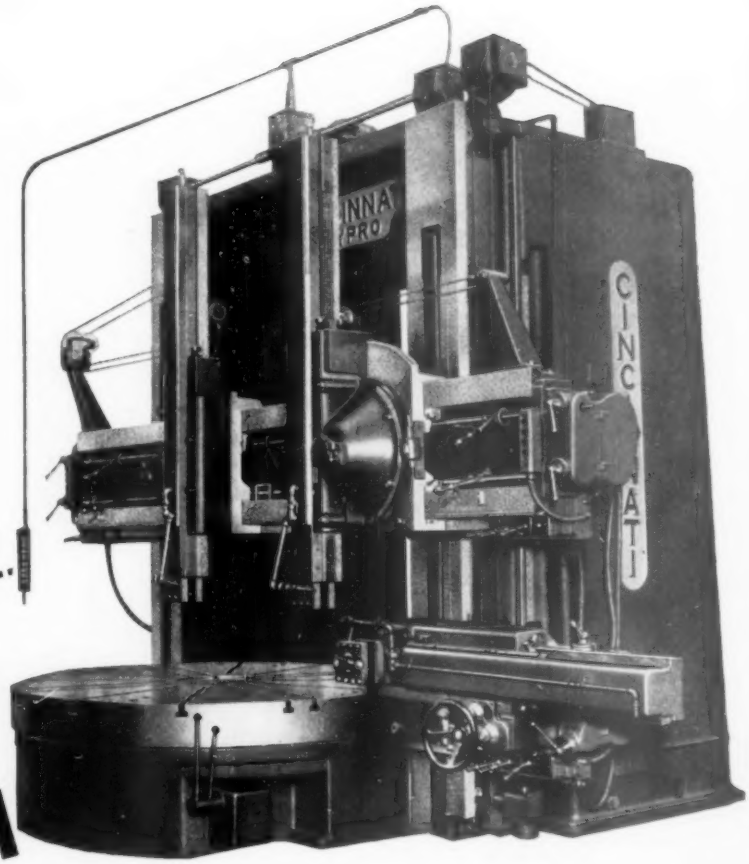

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Hydraulic design is simplified immeasurably. A complex circuit is delivered in a "package" ready to attach and operate. Savings in installation and maintenance costs alone make the unit well worth while. Another important advantage is the sole responsibility of Vickers Inc. for the complete hydraulic actuating circuit. Every Unit has the benefit of experienced assembly and is pretested at the factory so that it is ready for immediate operation.

Ask for Bulletin 47-45 describing the many advantages of Vickers Custom-Built Hydraulic Power Units.

VICKERS Incorporated
DIVISION OF THE SPERRY CORPORATION
1416 OAKMAN BOULEVARD • DETROIT 32, MICHIGAN

Sales Engineering and Service Offices: ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEWARK • PHILADELPHIA • ROCKFORD ROCHESTER • SEATTLE • ST. LOUIS • TULSA • WASHINGTON • WORCESTER

3320

In your plant . . . on your products—

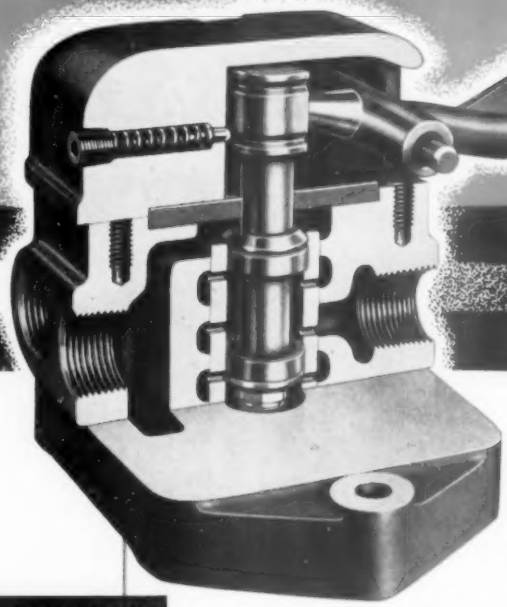
USE THESE NEW **"LOGAN"**

AIR CONTROL VALVES

★ NEW, IMPROVED CONSTRUCTION

★ EVERY TYPE OF CONTROL

★ 79 MODELS—COMPLETE SIZE RANGE



This new, complete line of piston-type air valves offers the most convenient, most efficient control for each of your problems. 79 models are now available in a broad range of sizes, for use in your own manufacturing or processing operations . . . for replacement . . . for original installation in the air-operated equipment you market. Here are some of the advantages:

EFFORTLESS CONTROL—Balanced design—valves do not operate against air pressure.

INFREQUENT MAINTENANCE—No rod packing or valve seats to become worn. Self-cleaning.

POSITIVE ACTION—Pistons have long-life synthetic cup packings to prevent leakage.

SIMPLE INSTALLATION—Compact design permits use in limited space and close to other equipment.

EASY TO RECONDITION—No need to disturb air line connections when replacing cup packings. After top or end cover screws are taken out, piston is quickly removed and replaced.

Use these new Logan Air Valves for manual or foot, remote, semi-automatic, automatic, time delayed, interlocking or sequence control systems. Get positive, trouble-free operation in controlling air cylinders and other air-operated equipment. Take advantage of the improved Logan Air Valve design in your plant and on your products. Investigate today.

DIRECT OPERATED

MANUAL (2 and 3 position) Straight or bent handle with spring return to top or bottom, or ball detent. Foot, manifold or flange (recessed) mounting.

FOOT (latching and direct control)

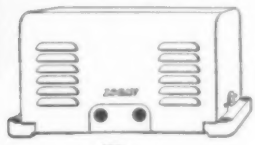
CAM

LIGHT DUTY (¼" ports)

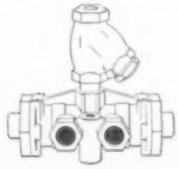
Operated by push button, palm button, toggle, cam or built-in air cylinder.

REMOTE OPERATED

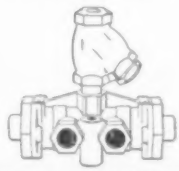
ELECTRIC (direct-acting)



Valve piston operated by lever from solenoid. Controlled by push button or limit switch.



BLEEDER

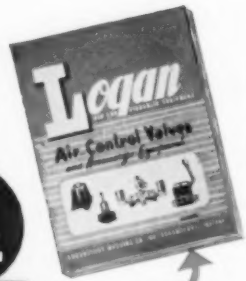


Controlled by remote 2-way bleeder and 3 or 4-way pilot operating valves, with operation by hand, foot, toggle, cam, electric switch or built-in air cylinder.

PILOT PRESSURE (2 and 3 position)

FREE ENGINEERING SERVICE

Ask Logan engineers for valuable assistance in designing complete air circuits and selecting effective types of equipment. No obligation.



WRITE FOR THIS NEW CATALOG

Logan SAVES ★TIME ★EFFORT ★MOTION

Air and Hydraulic Equipment

LOGANSPORT MACHINE CO., INC.

504 CENTER AVE. LOGANSPORT INDIANA

CHUCKS • CYLINDERS • VALVES • PRESSES • SURE-FLOW COOLANT PUMPS

Why "M-11" produces

MORE TAPPED HOLES PER TAP

M-11 is a chrome-cobalt high speed steel used exclusively by Detroit Tap and Tool Company for taps, thread gages and thread milling cutters. Some of the reasons for its use are:

COBALT . . . Takes the human element out of hardening. THIS MEANS THAT UNIFORM HEAT-TREAT CAN BE OBTAINED AUTOMATICALLY!

Increases the red hardness over ordinary HSS. THIS MEANS M-11 TAPS ARE HARDER, TOUGHER AT OPERATING TEMPERATURES.

CHROMIUM . Increases toughness and strength of steel after heat treatment. THIS MEANS LESS BREAKAGE.

Causes hardness to penetrate deeper and more uniformly. THIS MEANS SAME QUALITY AFTER AS BEFORE SHARPENING.

Resists corrosion. PROTECTS TOOLS IN TOOL ROOM. ALLOWS GREATER LATITUDE IN COOLANTS.

Permits slower cooling after heat-treat. ELIMINATES NEED FOR QUENCHING WITH ITS CHANCE OF PRODUCING MINUTE HEAT CRACKS AND WARPAGE.

Provides greater resistance to abrasion. THIS MEANS MORE PIECES PER SHARPENING, MORE THREADS PER TAP.

This combination of chromium and cobalt in Detroit Tap's M-11 high-speed steel is available to you at no increase in cost over quality taps made of ordinary high-speed steels. And back of every M-11 tap, thread gage and thread milling cutter is Detroit's SERVICE — a service which can make the proud claim:

WE'VE NEVER "SHUT DOWN" A LINE YET!!

The Home of
"M-11" CHROME-COBALT HSS TAPS, THREAD MILLING CUTTERS & THREAD GAGES

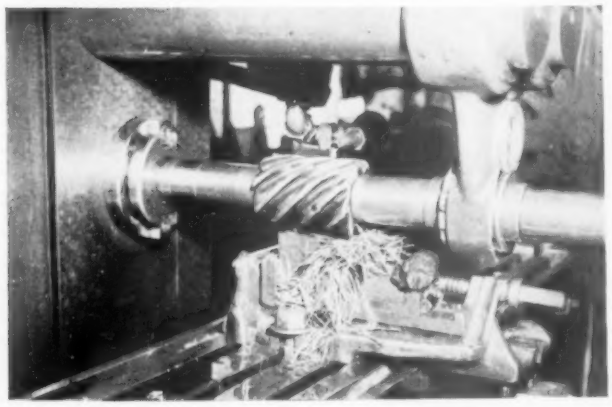
DETROIT TAP & TOOL CO.
8432 BUTLER STREET • DETROIT 11, U. S. A.

RESTORE BROKEN TOOLS THIS QUICK, EASY WAY WITH EASY-FLO

1. Here, for example, is a milling cutter that looks about ready for the scrap heap. But see how simply it was reclaimed with the low-temperature silver brazing alloy EASY-FLO and its teammate Handy Flux.

2. Here's the brazing set-up. Parts are cleaned and simply placed together with a weight to hold them in place. Internal heat, in this case, is supplied by a carbon rod in the bore, shorted across a transformer.

3. Here's the job in process. Outside heating is done with an oxyacetylene torch which is kept moving back and forth to secure uniform heating and EASY-FLO is applied by hand.



4. And here's the cutter, back on the job, good as new. All kinds of milling and form cutters, broaches, drills, taps, circular and band saws, are now being repaired the fast, low-cost EASY-FLO brazing way.

BULLETIN 14 gives full details about the EASY-FLO method, with step-by-step directions. Write for a copy today.

(Photos courtesy of Henry Disston Saw Co., Toronto)

HANDY & HARMAN

82 FULTON STREET NEW YORK 7, N. Y.

Bridgeport, Conn. • Chicago, Ill. • Los Angeles, Cal. • Providence, R. I. • Toronto, Canada

Agents in Principal Cities

Facts about GAGES

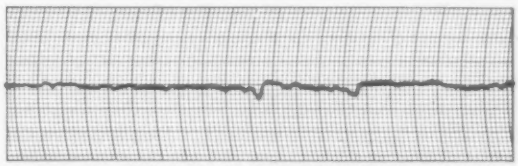
Most gages look alike, but some gages will outwear others many times. *Why is that?* The answer is something which cannot be seen by the naked eye. It is in the *finish* of the surface of the gage.

The *long-wearing* gages have surfaces that have been ground *AND LAPPED*. For example, if you magnified the profiles of the threads of gages, you could see the difference.

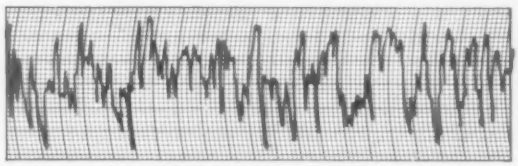
◀ This gage has been ground **AND LAPPED** to give many points of surface contact which insures longer gage life.

But this gage has ▶ **GROUND ONLY** finish, resulting in fewer points of surface contact and an early loss of accuracy.

This difference is even more apparent when the two finishes are compared by means of a Surface Analysis Graph.



GROUND and LAPPED SURFACE



GROUND ONLY SURFACE

This is an important fact for buyers of gages to know. GTD "Greenfield" Gages are ground AND LAPPED to an extremely high degree of finish. This "inbuilt" extra wear gives long and accurate service and better value to users—one reason for GTD "Greenfield's" reputation as a maker of fine gages.

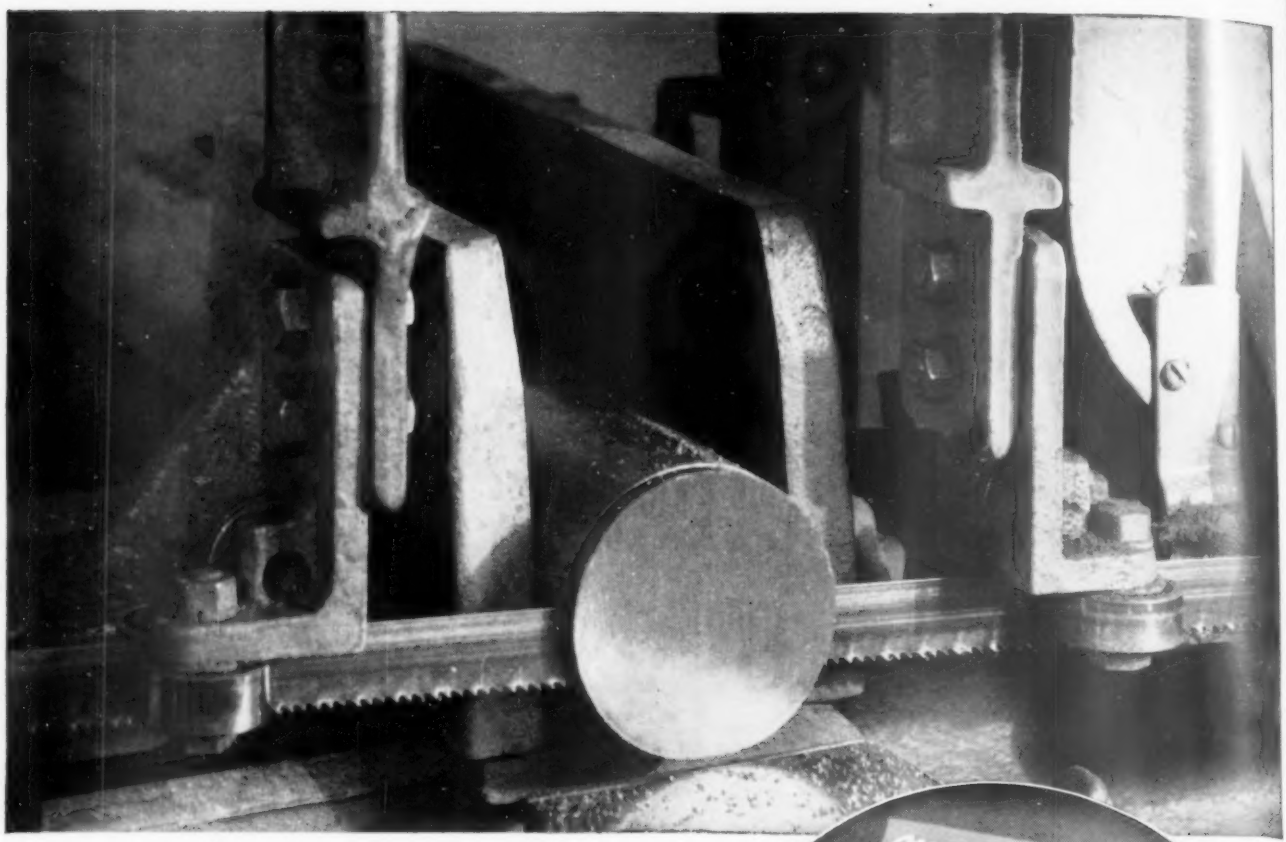
GTD GREENFIELD

World's Leading

THREADING TOOLS

When you buy GTD "Greenfield", you get a quality of product that comes from the world's largest, most modern threading tool plant and its research staff of threading engineers—PLUS SERVICE from the leading distributors and GTD "Greenfield's" field men in every industrial center.

GREENFIELD TAP and DIE CORPORATION GREENFIELD MASSACHUSETTS



Climb on the SIMONDS "BAND-SAW WAGON"

Send for this free book

Save Thousands of Hours by Band-Saw Cutting . . . instead of Shaping, Milling, Turning, Drilling

Getting to be a "Big Parade" . . . the way shops are swinging to metal band-sawing . . . and keeping their one-purpose machines free to do the work for which they were designed.

Simonds Metal-Cutting Band Saws can do a score of jobs, and do them all at top speed and accuracy . . . cut-off work, contour cutting, and cutting of irregular shapes like jigs, dies, fixtures, as well as heavy straight production cuts . . . and many other similar jobs.

And Simonds Metal Bands earn top profits on these jobs because they're made to *stay* on the job many hours longer . . . running smoothly, easily, cleanly. Simonds special steel, perfect tooth-milling and even tooth-set . . . those are the Simonds *extras* that *pay you extra* on every Simonds Metal Band you buy. Order from your distributor today.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.
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PERFORMANCE IS BUILT INTO
NATIONAL METAL CUTTING TOOLS

MANUFACTURING FACILITIES

National Counterbores are available with or without pilots, and with taper shank or straight shank holders. National End Mills are available in a wide variety of sizes and types, including both double and single end.

● "Why is it that National tools last so much longer?" One reason, we believe, is that in our new plant at Rochester, Michigan, we have the most complete and up-to-date manufacturing facilities to be found anywhere. These facilities contribute to the performance built into National High Speed and Carbon Steel Twist Drills and Reamers, High Speed Steel Milling Cutters, End Mills, Hobs, Counterbores, and Special Tools.

Call Your Distributor

LEADING DISTRIBUTORS EVERYWHERE offer complete stocks of NATIONAL Cutting Tools. Call them for cutting tools or any other staple industrial product.

NATIONAL TWIST DRILL AND TOOL COMPANY

ROCHESTER, MICHIGAN, U. S. A. Tap and Die Division — Winter Bros. Co.

Distributors in Principal Cities • Factory Branches: New York • Chicago • Detroit • Cleveland • San Francisco

● "Lundbye" flash-chrome surfaces by Racine are more wear-resistant due to the extreme hardness obtained (up to 1200 Brinell). Racine "Tri-Chrome" restores worn tools without regrinding or lapping. Salvages machine parts by controlled deposits of up to .001" thickness. Write today.

Racine Plating Company, Inc.
RACINE, WISCONSIN
Specialists in Chrome Plating
COPPER • NICKEL • CADMIUM • POLISHING • PICKLING

SPECIFY *Van Keuren*

WIRE TYPE PLUG GAGES

Tool Steel
High Speed Steel
Chromium Plated Carboloy

Wire Type Plug Gages were originated by the Van Keuren Co. in 1925. They are now in almost universal use for gaging small holes.

Longer lasting precision and lower gage cost are assured because the entire 2" length of the gaging unit can be used. When the end becomes worn, it is ground off and a new section of the original accuracy is moved out for use. The wire unit is securely held in the handle by a split bushing and a headless set screw.

Van Keuren Wire Type Gages are made to Class B accuracy +.00005" —.00000" on the Go units and ± 000025" on the No Go units. Closer or wider tolerances can be supplied if desired. On your next order specify VK Wire Plug Gages. VK Carboloy for long runs because of the enormous saving in gage cost. VK Carboloy for fussy jobs because of the infinitesimal gage wear and insurance that the parts will be within the specified limits. VK Tool Steel—High Speed—Precision Chromium for less exacting jobs. You will be assured of the best in accuracy, quality and delivery. The 160-page Van Keuren Catalog No. 33 gives full information on wire type plug gages and other precision measuring equipment. It also includes simplified formulas for measuring threads, splines, gears and worms. Your copy of this valuable handbook will be sent on request.

THE *Van Keuren* CO., 174 Waltham St., Watertown, Mass.
28th YEAR

Light Wave Equipment • Light Wave Micrometers • Gauge Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Measuring Wires • Carboloy Plug Gages.

SWARTZ STANDARD DRILL JIGS AND FIXTURE LOCKS

AN APPLICATION SHOWING MERITS OF THE LS TYPE FIXTURE. ROUND PARTS CAN BE HELD AGAINST HEAVY DRILL TORQUE BY MAKING DRILL PRESSURE HELP THE CLAMPING. STEEL INSERTS SET ON ANGLE GRIP PARTS; WHILE TOP PLATE AUTOMATICALLY FOLLOWS UP ANY LOWERING OF THE WORK.

ASK FOR CATALOG 941

SWARTZ TOOL PRODUCTS CO., INC.

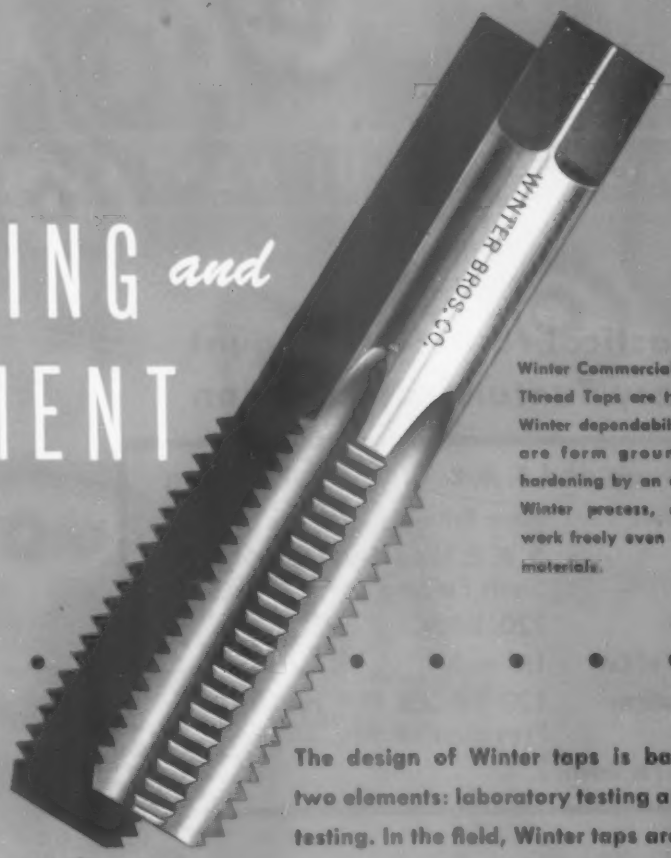
13330 Foley — Detroit, Michigan

Represented by

Cleveland—J. W. Mull, Jr.
Indianapolis—J. W. Mull, Jr.
Milwaukee—Geo. M. Wolff, Inc.
Chicago—Ernie Johnson
Canada—Hi-Speed Tools, Ltd., Galt, Ont.
Houston—Engineering Sales Co.
Los Angeles—Production Tool Engineering
Boston—A. R. Shevlin Co.
Pittsburgh—Tool Engineer Products
Toledo—J. W. Mull, Jr.
Philadelphia, Pa.—Morgan Tool & Equipment Co.

WINTER BROTHERS TAPS ARE DEPENDABLE

PRODUCT ENGINEERING *and* DEVELOPMENT



Winter Commercial Ground Thread Taps are typical of Winter dependability. They are form ground after hardening by an exclusive Winter process, and will work freely even on tough materials.

The design of Winter taps is based on two elements: laboratory testing and field testing. In the field, Winter taps are tested under actual production conditions. Reports of these tests are forwarded to the Winter laboratories. Here the information gained in the field is used to guide experiments in the development of better cutting tools. That is why when you specify Winter Taps you get taps which incorporate the latest advancements in metal cutting.

Always at Your Service

YOUR LOCAL DISTRIBUTOR carries a complete stock of WINTER Taps on his shelves—as close to your tapping problems as the telephone on your desk.

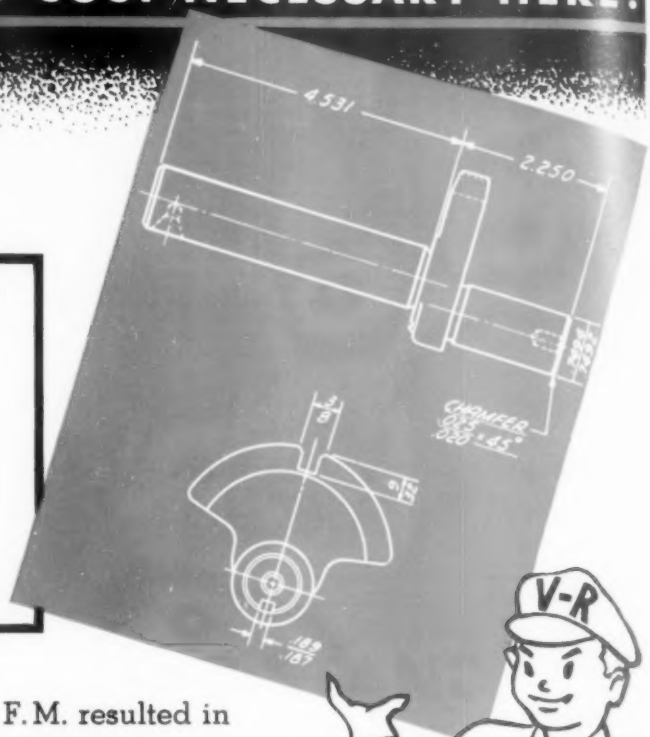
Winter Brothers COMPANY

ROCHESTER, MICH. and WRENTHAM, MASS. • Distributors in Principal Cities
A Division of the National Twist Drill and Tool Company • Branch Stores: San Francisco, Chicago, Detroit

Report No. 7

ON TANTUNG®

NO NEW EQUIPMENT COST NECESSARY HERE!



It's practical results that count on every Tantung application

Tantung and S. A. E. 1144 Steel Forging

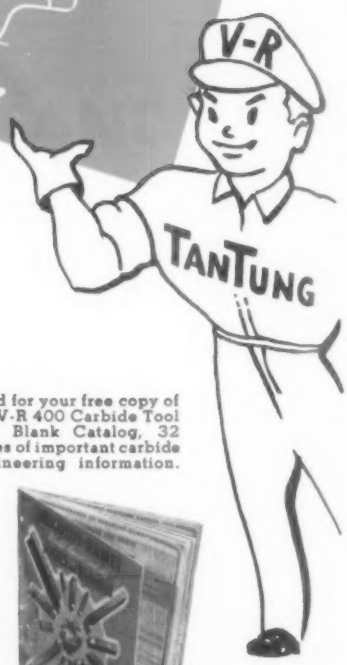
Machine:	New Britain Automatic
Part:	S. A. E. 1144 Steel Crank Shaft Forging
Speed:	120 S.F.M.
Depth of Cut:	1/8 inch
Production:	120 PIECES PER HOUR Previous Practice, 35
Pieces Per Grind:	750

REPORT:

Previous practice using H.S.S. at only 67 S.F.M. resulted in a maximum of 35 pieces per hour. Manufacturers contemplated purchasing new machines in an effort to increase production, BUT—on testing a complete Tantung tool set-up new equipment was cancelled.

SUGGESTION:

Try Tantung today on your troublesome and costly production problems. Remember! Tantung, the tough, shock resistant, non-ferrous cast alloy performs at far higher feeds and speeds on your present equipment than high speed steels.



Send for your free copy of the V-R 400 Carbide Tool and Blank Catalog, 32 pages of important carbide engineering information.

Write or call your nearest V-R Field Engineer for courteous, experienced help on your tough production problems. Remember, there is always an effective and economical solution TO ANY TOOLING PROBLEM with V-R carbide or Tantung tools.

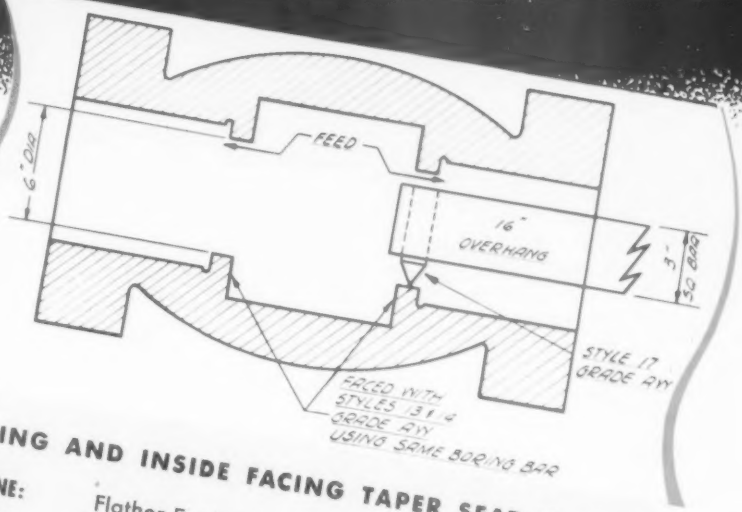
VASCOLOY-RAMET CORPORATION NORTH CHICAGO ILLINOIS

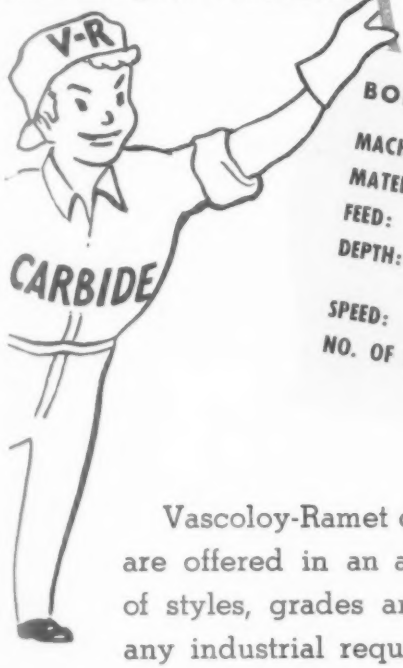
District Sales and Service in Principal Cities

An affiliate of The Fansteel Metallurgical Corporation and The Vanadium Alloys Steel Company

FROM 40 TO 1/2 PROVES THERE IS NO SUBSTITUTE FOR V-R® CARBIDE

Recently an eastern manufacturing concern had the unfortunate experience of having production drop from 40 to 1/2 piece per grind when circumstances forced substituting for V-R carbide.





BORING AND INSIDE FACING TAPER SEAT VALVES

MACHINE:	Flather Engine Lathe
MATERIAL:	Tough Cast Iron
FEED:	3/32" per Revolution on Bore
DEPTH:	On Bore — 3/16" to 1/4" on a Side (as much as 3/8" due to castings being non-concentric)
SPEED:	100 S. F. M.
NO. OF PIECES:	40 Pieces Between Grinds with V-R Grade AW Less Than 1/2 Piece with Substitute

Vascoloy-Ramet carbide tools and blanks are offered in an almost unlimited choice of styles, grades and dimensions to meet any industrial requirement.

Call or write your nearest V-R Field Engineer and obtain the courteous, experienced service that has earned V-R its enviable reputation of "Maker of the World's Finest Carbides."

SEND for your copy of the NEW VR-400 Carbide Tool and Blank Catalog. 32 pages of vital carbide engineering data. Address Dept. TE-247.

VASCOLOY-RAMET CORPORATION NORTH CHICAGO, ILLINOIS, U. S. A.

District Sales and Service in Principal Cities

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SNYDER MACHINES CONTROL COSTS

TYPICAL INDUSTRIES USING SNYDER-BUILT MACHINES

- Aircraft
- Automotive
- Railroad
- Refrigeration
- Farm Equipment
- Coal Mine Equipment
- Electrical Manufacturing
- Pharmaceuticals
- Glass Manufacturing
- Food Processing
- Valve Manufacturing
- Oil Producing

23 Years of Successful Cooperation with Leading American Industries

SNYDER TOOL & ENGINEERING CO.

3400 E. LAFAYETTE, DETROIT 7, MICHIGAN

* The wedge is the world's simplest and strongest mechanical device.

the * wedge begets

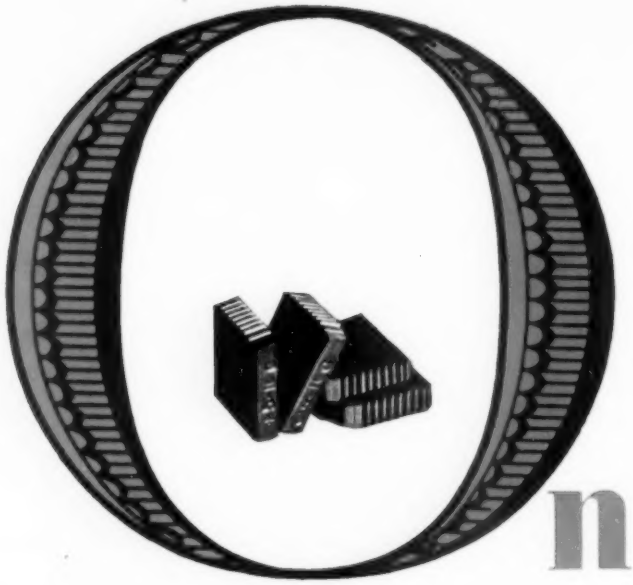
the only cutter with immovable blades

All O K MILLING CUTTERS and MULTIPLE OPERATION TOOLS consist of just TWO components — the BODY and the BLADES. This revolutionary idea was the conception of a practical toolmaker, a man endowed with the genius of simplicity. A block of steel forged into the shape of a wedge became the blade, with one side smooth, the other serrated. Blade slots in the body were tapered and serrated to match. This prevented tipping and permitted close adjustment to compensate for wear. The locking principle makes blades immovable during a cut and replaceable with minimum downtime. No pins, screws, gibs or extraneous locking devices are needed.

Write for new catalog 13.

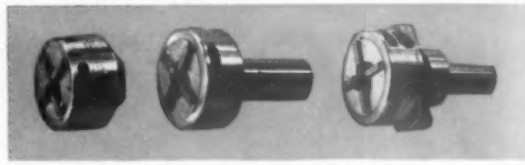
the OK Tool Company, inc.

30 HULL ST., SHELTON, CONNECTICUT



One set

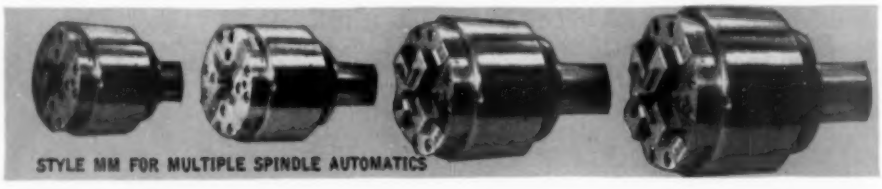
of low price, high quality, high speed insert chasers fits all these



SOLID ADJUSTABLE DIE HEADS

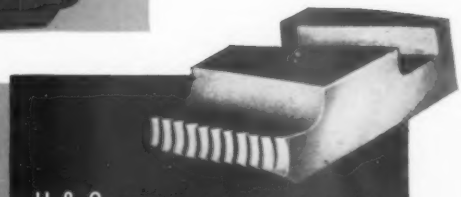
H&G Insert Chaser DIE HEADS

STYLE DM FOR B & S AUTOMATICS, ETC.



STYLE MM FOR MULTIPLE SPINDLE AUTOMATICS

STYLE DMS FOR TURRET LATHES



H & G GENERAL PURPOSE DIE HEADS use the famous H & G Hobbed (Tapped) Chasers that fit the thread like a nut fits a lead screw. The helix is correct at all points of contact — the major, minor and pitch diameter. It is the only chaser to meet such requirements — the only really true chaser made. Heads for all machines.

Write for Literature and Free Handy H & G Speed Calculator

THE EASTERN MACHINE SCREW CORPORATION

27-47 Barclay Street, New Haven, Conn.

THE TOOL ENGINEER'S *Service Bureau*

FREE BOOKLETS AND CATALOGS CURRENTLY OFFERED BY MANUFACTURERS

LITERATURE FEATURED IN ADVERTISEMENTS THIS MONTH

A1. **Aber Engineering Works, Inc.** Detailed information on "Curved Tooth" milling cutters.
A2. **Acme Industrial Co.** Catalog of Drill Jig Bushings.
A3. **Air-Trol Co.** Catalog of AIR-TROL pneumatic holding devices, arbor presses, etc.
A4. **Armstrong Bros. Tool Co.** Catalog of Tools and Tool Holders.
A5. **Behr-Manning (Division of Norton Co.)** 24 page booklet covering Service Packaging of coated abrasives.
A6. **Carlyle Johnson Machine Co.** Catalog TE12, detailed information.
A7. **Carboloy Company.** Booklet DR-480 showing how to save 40% in dressing costs.
A8. **Delta Mfg. Div.** Bulletin A-14-3 describing Delta Super-Hi Drill Presses.
A9. **Delta Mfg. Div.** Bulletin A-17 describing Delta 17-inch Drill Presses.
A10. **Delta Mfg. Div.** Bulletin A-20 describing Delta Cut-Off Machines.
A11. **Delta Mfg. Div.** Bulletin A-23 describing Delta Toolmaker Grinders.
A12. **Delta Mfg. Div.** Bulletin A-28 describing Delta 14-inch Metal Cutting Band Saws.
A13. **Delta Mfg. Div.** Bulletin A-31 describing Delta Abrasive Finishing Machines.
A14. **Eastern Screw Machine Corp.** Current catalog and handy H & G Speed Calculator.
A15. **Ex-Cell-O Corp.** Bulletin No. 31631, showing varied applications of Ex-Cell-O machines.
A16. **Gairing Tool Co.** Illustrated booklet of E-Con-O-Mill Cutters and Machines.
A17. **Handy & Harmon.** Bulletin 14 on the EASY-FLO method of restoring broken tools.
A18. **Hannifin Corp.** Bulletin NP-1007-J describing high speed, air operated presses.
A19. **Haynes Stellite Co.** "Haynes Stellite Metal-Cutting Tools."
A20. **Heald Machine Co.** Bulletin covering Centerless Internal Grinding Machines.
A21. **Illinois Tool Works.** "Design of Gear Teeth" a new 16 page booklet.
A22. **Latrobe Electric Steel Co.** Three booklets on Latrobe's four DESEGATIZED High Carbon—High Chromium Die Steels.
A23. **R. K. LeBlond Machine Tool Co.** Set of Bulletins covering LeBlond machines and fixtures.
A24. **W. F. Meyers Co., Inc.** Meyco Bushing Catalog No. 13.
A25. **Motch & Merrywenther Machinery Co.** Bulletin T-2 covering M & M Slitting Saw Blades.
A26. **The OK Tool Co.** Catalog 13 describing O.K. milling cutters and multiple operation tools.
A27. **O'Neil-Irwin Mfg. Co.** 40 page Di-Acro Catalog of detailed information on brakes, shears, etc.
A28. **Pratt & Whitney.** Two booklets—"BURology" and "Keller Burs and Accessories."
A29. **Reed Rolled Thread Die Co.** Bulletin A22-1 describing cylindrical-die thread rolling.
A30. **Geo. Scherr Co., Inc.** Small Tool Catalog.
A31. **Scully-Jones and Co.** Complete details of multiple spindle drilling and tapping.
A32. **L. S. Starrett Co.** New Starrett Dial Indicator Catalog.
A33. **Sunnen Products Co.** Bulletin on Sunnen precision honing.
A34. **Super Tool Co.** Bulletin covering Super Ejector Type Tools.
A35. **Van Keuren Co.** Catalog No. 33 giving full information on wire type plug gages.
A36. **Vascoloy Ramet Corp.** 32 page catalog of V-R 400 Carbide Tools and Blanks.
A37. **Wendt Sonis Co.** W-S Speed and Feed Calculator on reaming and other operations.
A38. **S. B. Whistler & Sons, Inc.** Two catalogs: "Whistler Adjustable Perforating Dies" and "Whistler Heavy Duty Adjustable Perforating Dies."

TRADE LITERATURE

1. Boring Machines

The new Multi-Way Bore-Matics, Models 233, 333, 232, and 332, for simultaneous boring of two or more holes from various directions, are fully described in new bulletin. *The Heald Machine Co.*

2. Brazing of Carbide

Educational pocket booklet gives practical aid on how to braze carbide with maximum efficiency and economy. Describes equipment and materials required by various methods of brazing. *Adamas Carbide Corp'n.*

3. Centering Machine

Folder carries illustrations of newest designs in single-spindle, single and duplex-head centering machines, giving specification data in concise form. *The Whiton Machine Co.*

4. Chuck, Gear, Pitch Line

Custom-built chucks, featuring extreme accuracy, quick chucking, and versatility, are announced in bulletin. *Garrison Machine Works, Inc.*

5. Conveyors, Portable Roller

Bulletins fully describe units and show actual applications of the Roll-Or-Wheel portable conveyors, and Three-Way Stretch featured at the recent Materials Handling Exposition. *The E. W. Buschman Co.*

6. Gage, Center Hole

Bulletin on Center Master, positive gage for exact control of center holes, shows step by step procedure for use of gage. *Veteran Machine Works.*

7. Grinder, Centerless Internal

Precision grinding, in mass production, of small to medium-large holes in parts which can be rotated on their O.D., is facilitated by fully automatic Heald Models 281-381, announced in bulletin. *The Heald Machine Co.*

8. Grinder, Cutter

Catalog of 48 pages gives complete information on grinder designed particularly for face milling cutters, grinding at a single setting the face, periphery, and corners of the cutter having from 4-30" dia. and a max. peripheral face of 7". Also includes practical instruction materal making it an operator's manual as well. *The Ingersoll Milling Machine Co.*

9. Grinder, Surface

Flat surface castings may be ground to within .001" in a few minutes by simply guiding casting back and forth across the grinding wheel set into precision-machined table. *Peterson Welding Laboratories.*

10. Motor Insulation

Booklet tells machine tool users how introduction of Fiberglas electrical insulation in machine tool motors has both simplified design and improved performance. *Owens-Corning Fiberglas Corp'n.*

11. Parallels, Toolmaker's

Magic parallels, for convenient elevation or support of work, for use on bench, surface plate, and many machine tools. Valuable to the tool or diemaker, or machinist. *Magic City Machine Tool Co.*

12. Piercing, Hydraulic

Brochure describes Hydro-Pierce unit method of piercing and forming sheet metal stampings. Actual applications, types of equipment, and specification data included. *Mid-West Hydro-Pierce, Inc.*

13. Planer Millers, Hypro

Forty-page illustrated bulletin shows many models of the Hypro Planer Millers, with such features emphasized as Centralized Pendant Station for Electronic Drive, Dual Purpose Milling Heads, Positive Rail Clamping Device, and others. *The Cincinnati Planer Company.*

(Continued on next page)

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14. Powders, Metal

Data on metal powders produced by atomization process is outlined in bulletin, offering new possibilities to fabricators of metal powder parts. *The New Jersey Zinc Sales Co.*

15. Presses, Standardized Hydraulic

Special bulletin includes detailed specifications and recommendations on the selection of presses, of which there are 75 standard models covering a wide range of applications and capacities. *Hannifin Corp.*

16. Pump, Fluid Power

Eight-page bulletin illustrates the variable delivery feed pump that's simple, compact, electro-hydraulically controlled, automatic pressure compensated, with many other features. *The Oilgear Co.*

17. Pumps, Hydraulic

Graphic illustration of the exceptional performance of the Hydro-Power radial piston-type pumps is given in folder. Pumps feature low power consumption, pressure adjustment, and flexible speed control. *Hydro-Power, Inc.*

18. Punching Units, Hole

Catalog of 16 pages shows wide versatility and economy of Wales C, E, and EJ multiple punching units which are independent and self-contained with nothing attached to press brake ram. *Wales-Strippit Corp'n.*

19. Rotary Files

Twelve-page catalog illustrates complete line of high speed and tungsten carbide rotary files for all industries. *The Charles L. Jarvis Co.*

20. Saw Blades, Metal Cutting

New wall chart provides ready information for selection of proper hand, band or power saw blade to use to cut any type metal. Also includes illustration of right and wrong ways to use blades. *Victor Saw Works, Inc.*

21. Saws, Circular

Sixteen-page bulletin tells how cut-off of metal to uniform lengths is assured with four basic machines, cutting stock from ¼" to 16½", all utilizing the Triple-Chip Saw Blade in diameters from 8" to 45", with Automatic Sharpeners to grind all blade sizes. *Motch & Merryweather.*

22. Shapers, Shear-Speed

Technical bulletin describes Shear-Speed Shapers and their use in production of splines, cams, sprockets, and other external shapes equivalent to those that can be produced internally by broaching. *Michigan Tool Co.*

23. Sharpener, Tool

Bulletin on the Model 2 Sharpener, a highly flexible machine for precision grinding of carbide-tipped and other tools used on Bore-Matics, where accuracy is essential. *The Heald Machine Company.*

24. Sharpening, Tap

Eight-page report on "Precision Tap Sharpening," using the Blake Flute Grinder, provided with diamond wheel dresser which permits dressing the wheel with accurate radius and thickness, without unloading. *Edward Blake Co.*

25. Slotter Equipment

Bulletin of 20 pages presents design and application details of the new 36" and 48" Hydraulic Slotters, featuring triple feed, ease of operation, and high speed ram stroke. *Rockford Machine Tool Co.*

26. Special-Purpose Machines

Brochure of 24 pages illustrates many of the milling and boring machines engineered and built to meet specific production requirements. *Fitchburg Engineering Corp'n.*

27. Speed Reducer

"Proof of the Pudding" is a collection of case histories, showing the remarkable economies being achieved with the small and compact—but rugged—fan-cooled worm gear Speedaire. *The Cleveland Worm & Gear Co.*

28. Speed Reducer

Technical bulletin describes operation and design of the new Cone-Drive Fan-Cooled Speed Reducers, and conversion of standard units to fan-cooled. *Michigan Tool Co.*

29. Tapping Machines

Folder announces Model E Tapping Machine with interchangeable lead screw feed, and designed for high spindle speeds, record economy, and fidelity of thread form. *The Cleveland Tapping Machine Co.*

30. Taps and Dies

First complete catalog, since acquisition of the Dowding Co., describes the entire Jarvis-Dowding line of taps and dies. *The Charles L. Jarvis Co.*

31. Valves, Control

Complete specifications and application data on control valves for steam, air, liquid, or gas, are included in 18-page data book. *The Sinclair-Collins Valve Co.*

32. Vises, Bench

Bulletin lists and describes precision-built vises, featuring entirely enclosed body, interchangeable and reversible jaws, light or heavy duty, and special-purpose jaws. *Acme Tool Co.*

33. Welder, Arc

Complete line of "Simplified" electric and gasoline engine-driven arc welders, electrodes, and accessories is described in 36-page catalog. *Hobart Brothers Co.*

34. Welding Gun, Double-Acting

Bulletin describes Gun and Booster that produces more than 3,000 spots per hour, assuring uniform point pressure and uniform weld, with no burning or sticking of points. *Dalhart Eng'g & Mfg. Co.*

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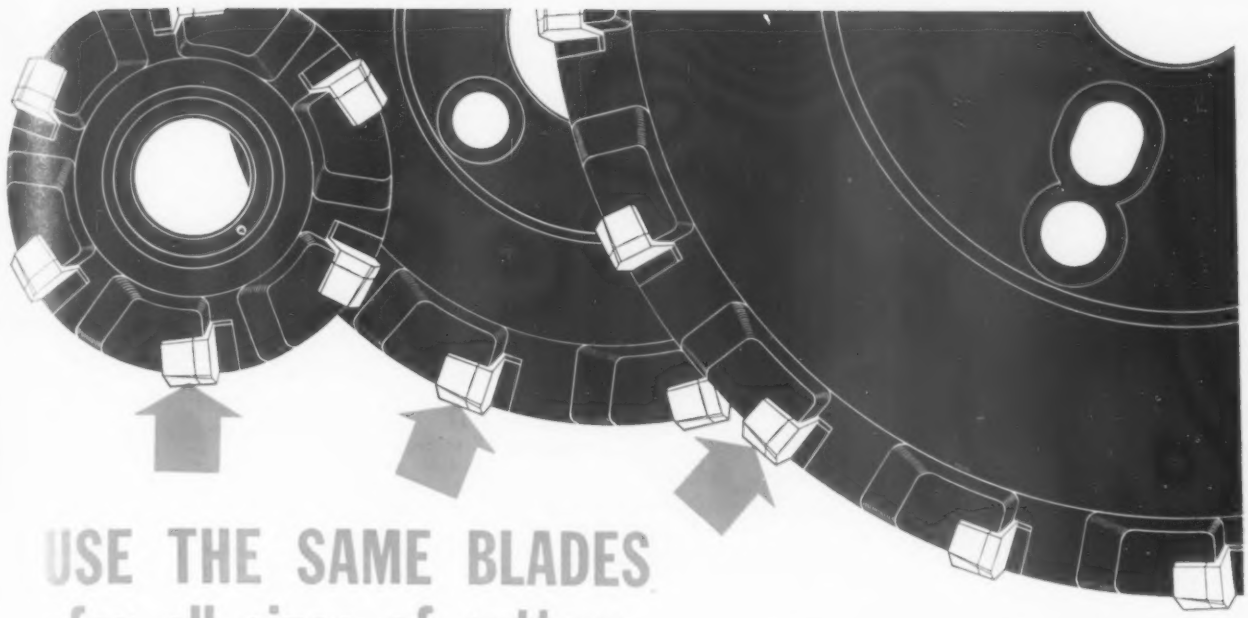

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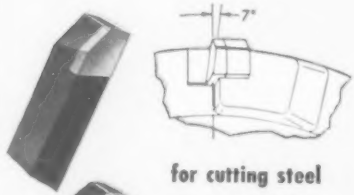

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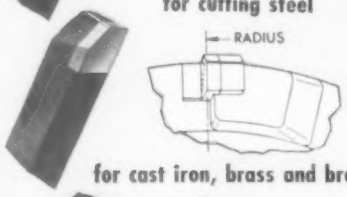

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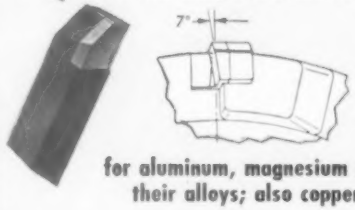

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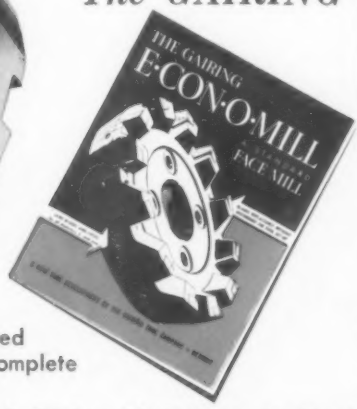

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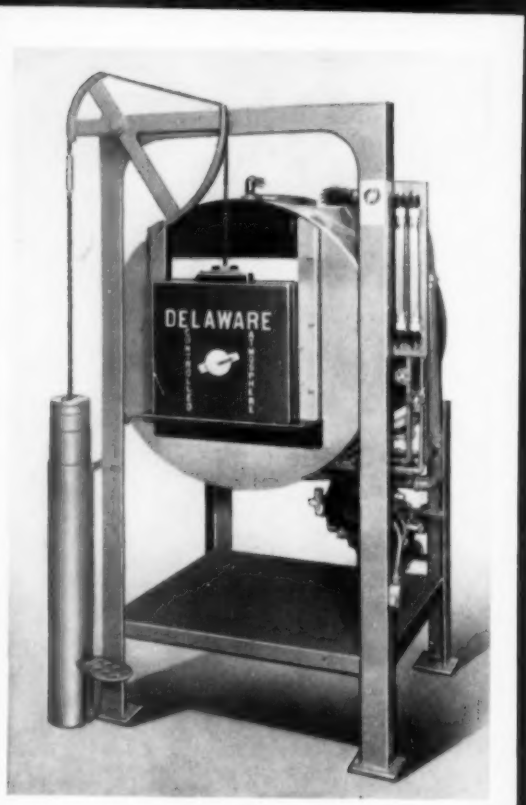

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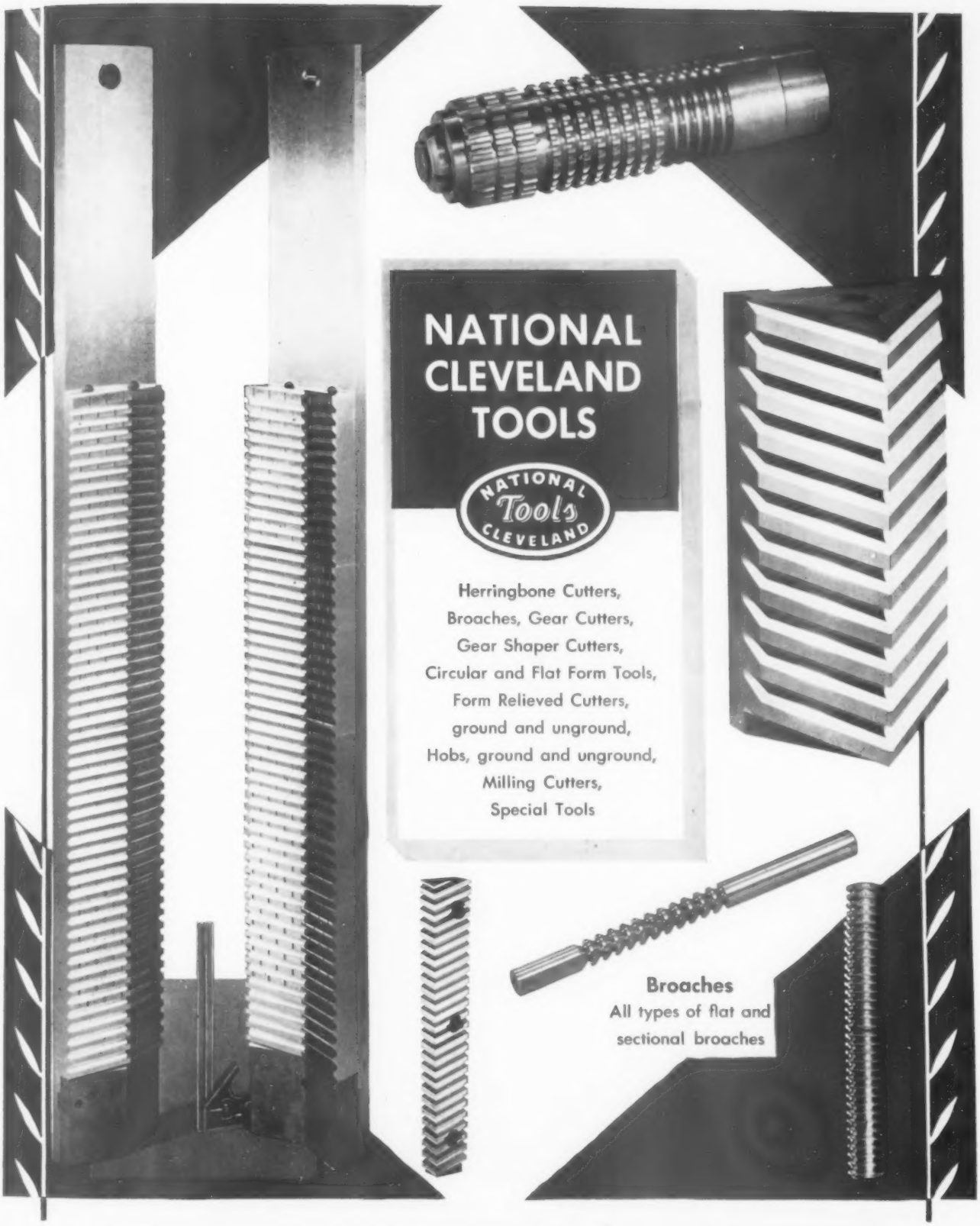

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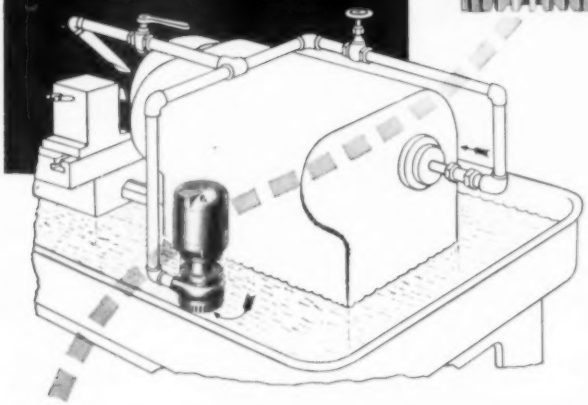

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Pioneer Pumps in Seal-type, Seal-less and Rollway designs for pumping coolants, cutting fluids, abrasive liquids, lubricants and water available in every type and size. Please describe your installation when writing for information.

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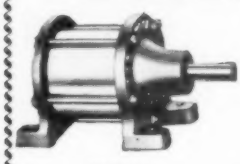

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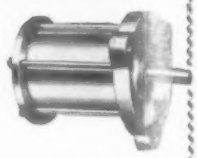

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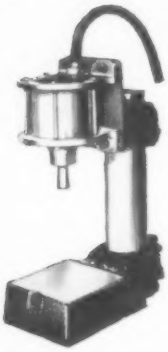

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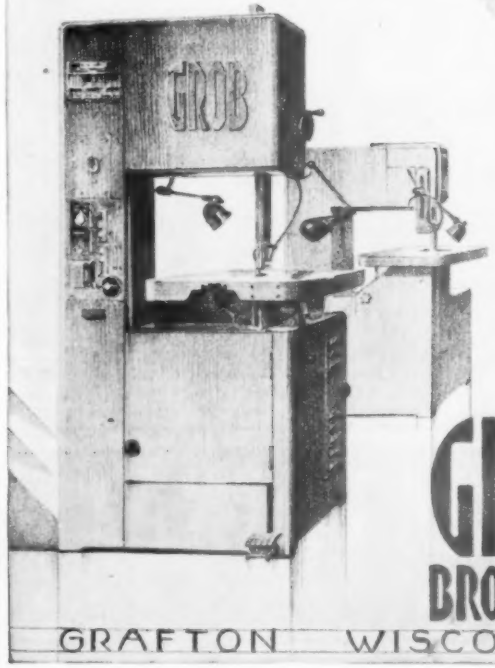

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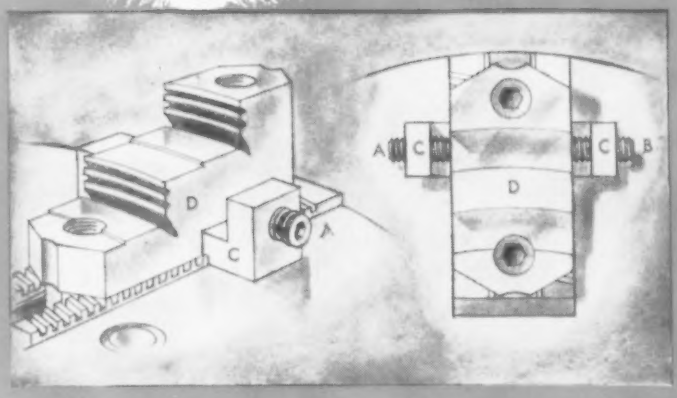
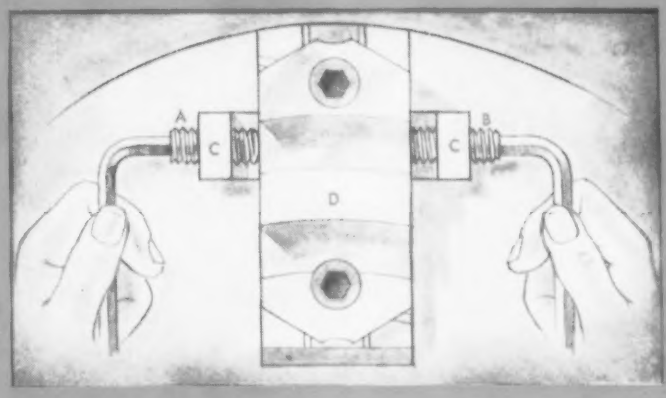


"Accralock" adjustments are obtained by loosening screw "A" and tightening screw "B," or vice versa, which causes key "C" to move to the right or to the left. This causes jaw "D" to move outward or inward under very precise control.



One full turn of the screws will move the jaw in or out .010". It is evident therefore, that accuracy of adjustment as close as .001" is easily possible. After adjustment has been made, tightening both screws positively locks the jaw in position.

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POWER CHUCKS

Power chucking devices enable operators to do *better* work and *more* work with far less fatigue. Write for your copy of the new catalog PO-62 describing this equipment in detail.

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Extra Clamping Action

and Quick Release...with GLENZER Eject or Lock

Use Eject or Lock Drivers where machine or work interferes with use of a drift. No lost time—no damage to machine or tools through unskilled use of drift by inexperienced or careless operators.

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- ROK-LOK—sensitive material clamp for accuracy
- DOUBLE-EDGED FORMING BLADE for close reverse bends
- NEW PRECISION STOPS control angularity of bends

This versatile metal forming machine was developed for use in model shops, experimental laboratories and production departments where it often replaces dies for all types of precision forming operations. Di-Acro Brakes will form a great variety of materials including bronze, stainless steel, aluminum and bi-metals.

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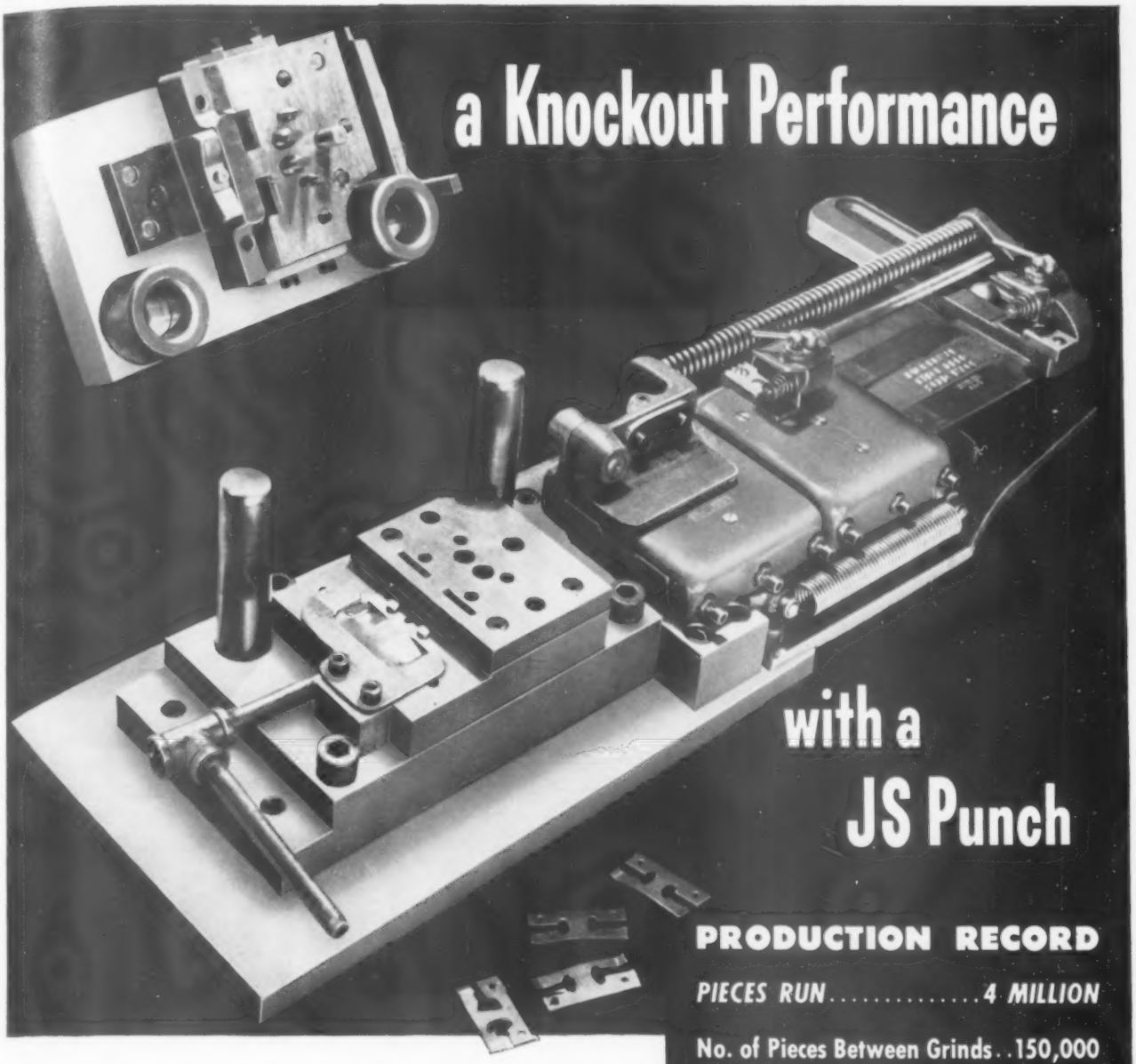

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PIECES RUN.....4 MILLION

No. of Pieces Between Grinds..150,000

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Punches and Cut-off Knives
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The Die is still in excellent condition

As evidenced above, J-S Chisel and Punch Steel —an oil-hardening steel for both hot and cold work—is exceptionally tough . . . stands up remarkably to fatiguing effect of repeated blows ...excellent for punches and for chisels, cutters, shear blades, pneumatic tools, etc.

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HEX-SOCKET SET SCREWS • SOCKET HEAD CAP SCREWS

ALLEN HEAD

NON-CORRODING "ALLENS" for applications where steel is subject to excessive moisture, chemical fumes or corrosive vapors. Made of "18-8 Type" *Stainless,* non-heat treated, non-magnetic. Set screws: stock sizes #6 to ½" diameter; cap screws: #8 to ½". N. C. threads only. Class 3 fit; Allen precision fastenings. . . Order of your local Allen Distributor, or write us for samples and literature.

THE ALLEN MFG. COMPANY
HARTFORD 2, . . CONNECTICUT, U. S. A.

When you want something "Special"

Specify GUILD
TRADE MARK REG.

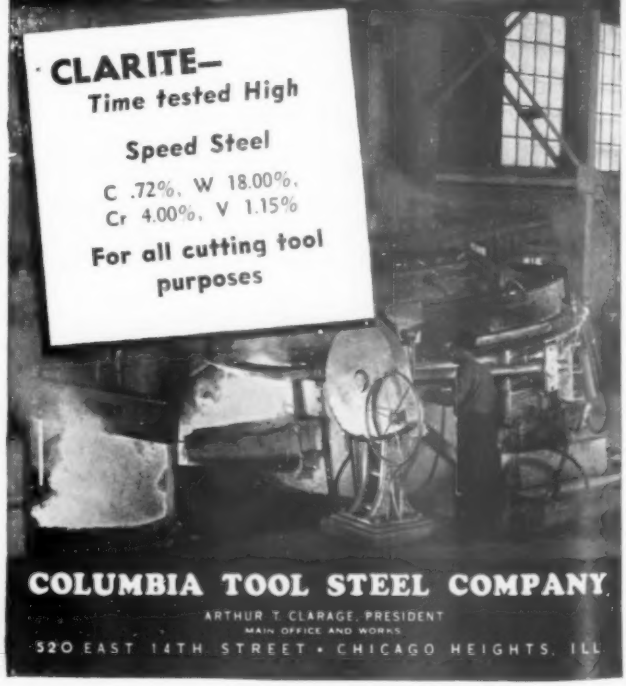
Special TOOLS and REAMERS
H. S. S. or Carbide Tipped

You can be certain of getting the *exact* tool you want . . . *exactly* as you want it . . . *exactly* when you want it.
Prompt quotations from your blueprints

METAL CUTTING TOOLS AND MANUFACTURING COMPANY
3956 W. Eleven Mile Rd. • BERKLEY, MICH. • Phone LIncoln 2-5600

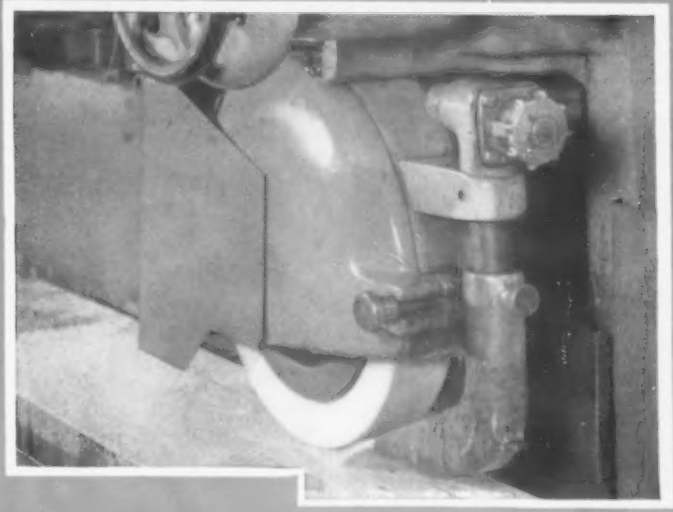
Columbia TOOL STEEL

CLARITE—
Time tested High Speed Steel
C .72%, W 18.00%, Cr 4.00%, V 1.15%
For all cutting tool purposes



COLUMBIA TOOL STEEL COMPANY
ARTHUR T. CLARAGE, PRESIDENT
MAIN OFFICE AND WORKS
520 EAST 14TH STREET • CHICAGO HEIGHTS, ILL.

the grinding job



Horizontal surface grinding of alloy steel stock on a Mattison Precision Surface Grinder. Repeated precision results and a fine finish on a production basis make grinding wheel selection of prime importance.

the wheel

W Borolon vitrified, WA36-J8-V1, size 20" x 3" x 10" c/s one side 12¼" x ⅝"; c/s other side 12¼" x 1". Selected for cool, fast grinding without danger of burning stock. Efficient for grinding hardened and high speed steel; special alloys including high carbon high chrome types.

Borolon — ALUMINUM OXIDE

Electrolon — SILICON CARBIDE

SIMONDS ABRASIVE CO.

PHILADELPHIA, PA.

Grinding Wheels

Complete line includes every shape and size.

Abrasive Grains

Mounted Wheels and Points

Surfacing Segments

Bricks and Sticks

where to get it

Simonds Abrasive Distributors in all principal industrial centers of the U. S. and in many foreign countries carry stocks and can advise on grinding wheel selection. Write today for Technical Manual on Modern Surface Grinding Practice. Also for name of nearest distributor.

SIMONDS ABRASIVE CO.

Philadelphia, Pa.

Electric Furnace Plant: Simonds Canada Abrasive Co., Ltd., Arvida, P. Q.

SIMONDS ABRASIVE COMPANY

is a division of

SIMONDS SAW AND STEEL CO.

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Saws, Machine Knives, Files

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Special Steels

SIMONDS CANADA SAW CO. LTD.

Montreal, Que.

Simonds Products for Canada

Quality control has characterized Simonds Abrasive Company products during more than 50 years as a major manufacturer of grinding wheels and abrasive products exclusively. This control begins with the abrasive grain produced in modern electric furnaces by Simonds Canada Abrasive Co., Ltd., and extends to the finished wheels for all types of grinding from roughing to precision finishing. This means consistently high wheel performance on every grinding job.

SIMONDS ABRASIVE COMPANY, PHILADELPHIA 37, PA. • DISTRIBUTORS IN ALL PRINCIPAL CITIES

- ★ GEAR SHAPERS
- ★ THREAD GENERATORS
- ★ SHAVING MACHINES
- ★ BURNISHING MACHINES
- ★ INVOLUTE MEASURING INSTRUMENTS
- ★ LEAD MEASURING INSTRUMENTS
- ★ RED LINERS
- ★ FELLOWS CUTTERS AND SHAVING TOOLS
- ★ PLASTIC INJECTION MOLDING EQUIPMENT

FELLOWS

A name famous for leadership in the design and manufacture of gear cutting equipment since 1896, serving the shops of America through a sales-service and engineering organization readily available at any one of the following addresses:

THE FELLOWS GEAR SHAPER COMPANY

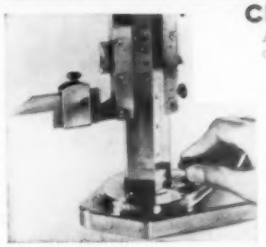
Head Office & Export Dept.
Springfield, Vermont

Branch Offices:
616 Fisher Bldg., Detroit 2
640 West Town Office Bldg., Chicago 12
7706 Empire State Bldg., New York 1

MACHINES AND TOOLS FOR ALL OPERATIONS FROM BLANK TO FINISHED GEAR

SCHERR aids to precision

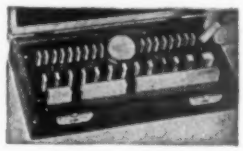
CHESTERMAN HEIGHT GAGE



A big, sturdy stabilized instrument. Fine adjustment by screw operated from knurled nut on base (see photo) eliminating rocking or shifting instrument while measuring. Finger pressure on two lugs releases split nut for rapid vertical adjustment of head. 2½" long vernier in place of the normal ⅝" vernier provides greater visibility without the need of magnifier or removing gage from work. Both English and metric readings one on each face of column. In sizes from 12" to 48" —capacities sufficient for the most unusual measurements.

OPTI-FLAT GLASS SURFACE PLATE

The basis for vertical measuring accuracy—an optically ground glass surface, flat within 50 millionths over the total area. A solid, non-warping thick disc of Pyrex brand glass, set in a heavy wood base with dust-proof cover. Immune to the internal strains which may affect the accuracy of metal surface plates, with the added advantages that accidental scratches cannot cause raised burrs, nor long usage wear the hard surface. For real accuracy in layout work and critical inspection. Two sizes—12" diam., 2" thick, and 16" diam., 3" thick. Also a complete stock of hand-scraped metal surface plates, angle irons, measuring irons, etc.



ULTRA-CHEX GAGE BLOCKS

Sets in size for all budgets. All blocks accurate to five millionths. Illustrated is the 34-block set, giving 80,000 combinations in steps of 1/10,000", with optical flat for checking wear. Low prices allow for constant shop use in setting tools, checking gages, etc. Many shops use a number of sets, with one master set for reference.

WRITE FOR FULL DETAILS ON THE ABOVE TOOLS, AND FOR THE SCHERR SMALL TOOL CATALOG.

GEO. SCHERR CO., Inc. 199-A LAFAYETTE STREET NEW YORK 12, N. Y.

NEW High Speed Air Operated PRESSES

- *Model M-1* 1/2 Ton Capacity
- *Model M-2* 1 Ton Capacity
- *ELECTRIC PUSH BUTTON CONTROL*

HANNIFIN

Designed and Built

to help you SPEED UP PRODUCTION

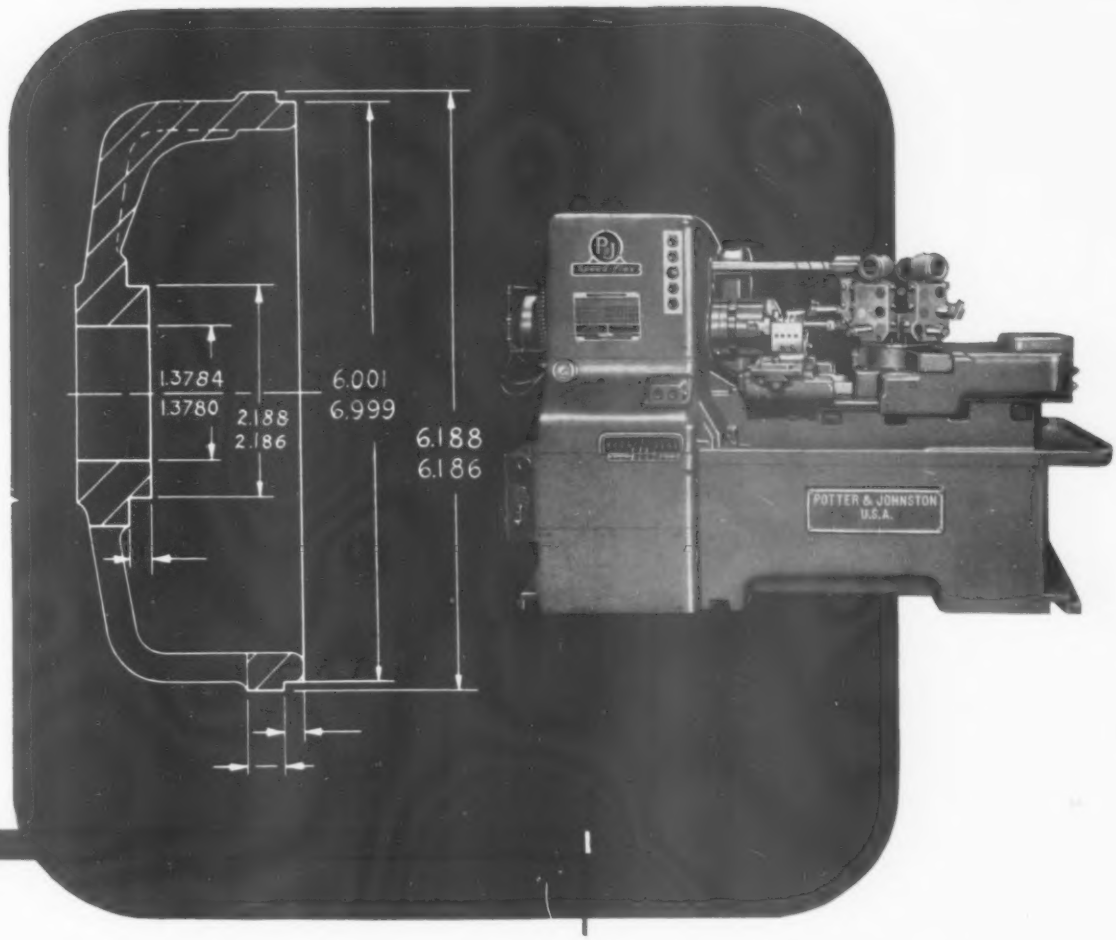
HERE'S help for manufacturers who want to speed up production on light stamping, press fit assembling, marking, die cutting, and similar operations. Take advantage of the opportunities offered by Hannifin's new high speed, air operated presses!

TWO MODELS: Model M-1 has 6" gap, develops 1270 lbs. ram pressure with 80 lbs. air. Model M-2 has 12¼" gap and 2650 lbs. capacity. Both moderately priced.

FAST OPERATION. Made possible by push button control through new electric solenoid valve. Stroke adjustable to work requirements. Every operating convenience.

QUALITY CONSTRUCTION. Built to big press standards for quality. Cylinder *"TRU-BORED"* and honed to satin finish. Working parts precision machined and finished. For information, see your local Hannifin representative or write for new bulletin NP-1007-J.

HANNIFIN CORPORATION
1101 So. Kilbourn Ave., Chicago 24, Ill.
AIR CYLINDERS • HYDRAULIC CYLINDERS • HYDRAULIC PRESSES
PNEUMATIC PRESSES • HYDRAULIC RIVETERS • AIR CONTROL VALVES



OTOR END SHIELD COSTS ARE SLASHED BY THE NEW POTTER & JOHNSTON -U SPEED-FLEX AUTOMATIC TURRET LATHE, PLUS P & J TOOL ENGINEERING

ke a look at this record:

ALLOWANCE FOR CHUCKING . . . . only 12 seconds
TO INDEX THE TURRET . . . . . only 18 "
ACTUAL CUTTING TIME . . . . . only 93.6 "

Which adds up to 2 minutes 3.6 seconds "Floor-to-Floor" time per piece, or 24.77 pieces in a "51 minute hour!"

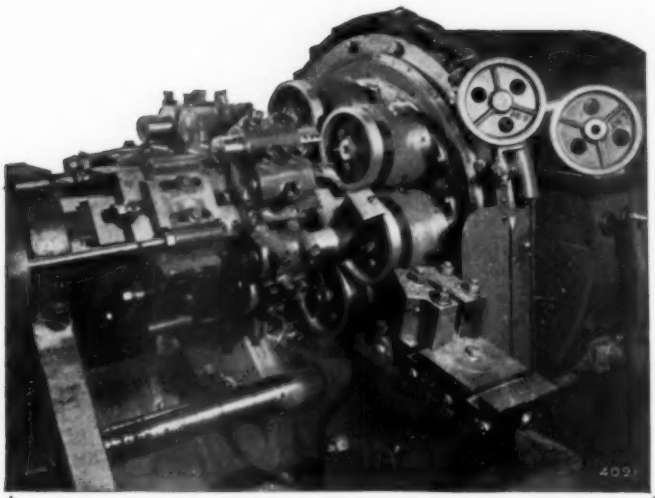
Now picture your work on this machine! Same size and type of Automatic ich day in and day out is giving this splendid performance on 6.187 inch diam- r cast iron motor end shields, will do equally profitable work for you on a e variety of parts.

Bear in mind that Potter & Johnston's new 3-U Speed-Flex weighs only 5000 unds and occupies only 16 square feet of your valuable floor space. Bear in d that its standard range of spindle speeds, from 73 to 1445 revolutions per ute (with 36 to 711 optional) gives full scope both to high speed steel and bide cutting tools, both on ferrous and nonferrous materials. Bear in mind t duration of non-productive phases in the automatic cycle have been reduced lowest terms by electro-pneumatic control and split-second timing. Bear in d that operating convenience of P & J 3-U machines attracts and holds vices of the best operators.

Experienced P & J tool engineers will tell you the economic and production ts in terms of your own tough jobs—if you will send blueprints, or sample parts, h specified limits.

POTTER & JOHNSTON

MACHINE CO., PAWTUCKET, R. I.



GEAR BLANKS ARE TURNED ACCURATELY AND SPEEDILY ON

"BAIRD" AUTOMATIC CHUCKING MACHINES

Here is shown a "Baird" No. 76H Chucking Machine, set up for turning, facing and boring gear Blanks made of a Special Cast Iron having a Rockwell hardness—85—90 B Scale.

The O.D. is finished turned to 6.800 plus or minus .001 and both faces are finished to 1.000 width, plus or minus .001.

The Hole is finished bored and reamed .750 diameter to plug gage and is concentric with the O.D. turning within .001 total indicator reading.

The work is held in Standard "Baird" Three Jaw Contracting Chucks, using stud type jaws for gripping. (The Spindle Turret is shown partially indexed to better illustrate the method of chucking.)

This gear is completely turned as shown to the required accuracy at the rate of 55 pieces per hour.

Selection of a spindle speed for each position, which is a special Baird Feature, permits high Spindle speeds in the finishing positions where carbide tools are used to produce the fine accurate surfaces required.

When you have Turning Operations that should be done profitably

"ASK BAIRD ABOUT IT."

THE BAIRD MACHINE COMPANY
STRATFORD, CONN.

ARMSTRONG

Every tool shown represents a full line of quality tools, known the world over as the finest of its type.

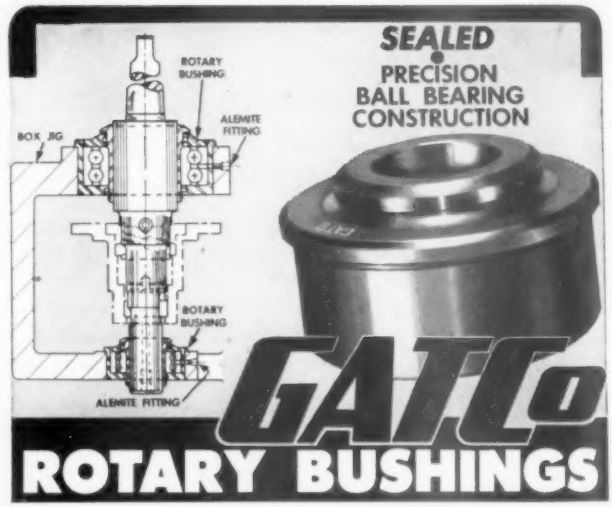
Write for catalog

Armstrong Bros. Tool Co.

"The Tool Holder People"

5257 W. Armstrong Ave. Chicago 30, Ill.

New York San Francisco



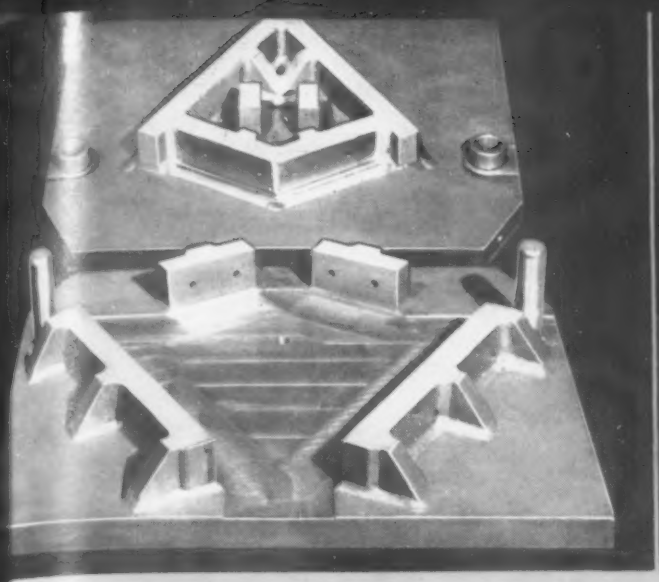
FOR DRILLING, CORE DRILLING, ROUGH AND FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work—or both.

Eliminates expensive tool construction—Reduces tool wear—Prevents seizure and pilot breakage—Especially adapted where precision is required.

Write for full information and prices

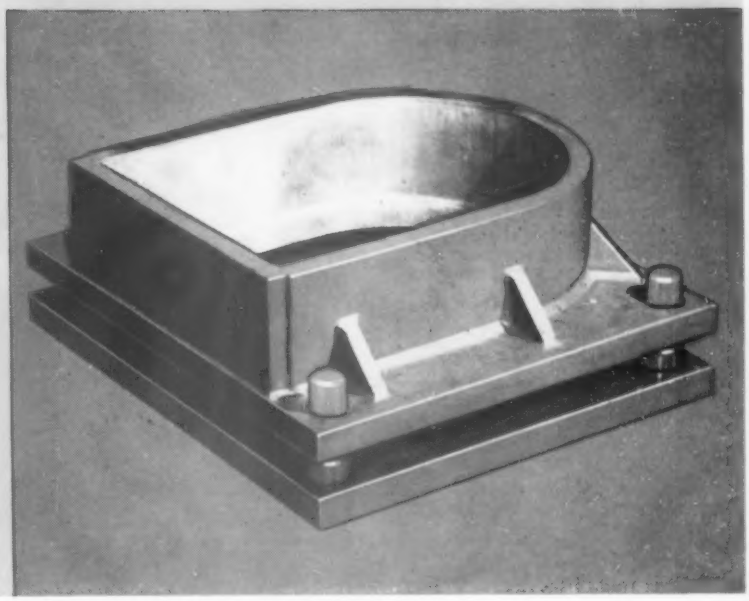
GIERN & ANHOLTT TOOL CO.
1302 Mt. Elliott Avenue • Detroit 7, Michigan



DANLY SPECIAL-PURPOSE DIE SETS

DIFFERENT SIZES
DIFFERENT SHAPES
DIFFERENT PURPOSES

The same DANLY Precision



THE design, shape, size of a die set is determined by its purpose. Many tool designers and engineers have found that only *specially* designed and constructed die sets can do the job efficiently. Torch cut pockets, slots, bored die pockets, planed or milled keyways, drilled knockouts, slug or hold-down holes, welded steel mounting pads—all of these operations and more can be performed at Danly during production of the die set.

This service can be especially valuable to you in the production of large die sets. Additional cutting and welding operations, so easily handled at Danly, may cause difficulty in the die shop or your own tool room where equipment is not specifically suited to large work.

The die sets shown on this page are typical of the kind of work performed in Danly's well-equipped shops. These sets are widely different, but all have the same *Danly Precision*. Freely consult Danly's engineering department for quotations.

DANLY MACHINE SPECIALTIES, INC., 2100 So. 52nd Ave., Chicago 50, Illinois

DANLY *Special* DIE SETS

MACHINED TO YOUR SPECIFICATIONS

For Economy and Efficiency

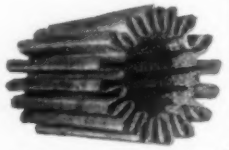
KEEP OIL CLEAN

with the **MARVEL**

SYNCLINAL FILTER FOR OILS & OTHER LIQUIDS

Triple Capacity—Triple Efficiency

- Filtering area equal to 3 like size units
- Faster flow under less pressure
- Screens for various oils & liquids
- Easy to install . . . Easy to clean
- Only 6 different parts, all readily replaceable
- For all oil re-circulating machines, hydraulic and Coolant systems, etc.



Multi-surfaced corrugations give filtering capacity of 3 like-size units.

30 DAY TRIAL AT OUR RISK

So certain are we of the remarkable performance of MARVEL SYNCLINAL FILTERS that we will accept orders for one or more filters on a 30-day trial basis. If YOU are not thoroughly satisfied, return for full refund. Write today for free new booklet No. 103. Complete engineering data and details show how Marvel Synclinal filters can be efficiently adapted to your particular needs.

Marvel Filters now available in 5 different sizes ranging in capacities from 5 to 30 gallons per minute.

VISIT OUR EXHIBIT AT THE
TOOL ENGINEERS INDUSTRIAL EXPOSITION, CLEVELAND, OHIO
March 15 to 19, 1948

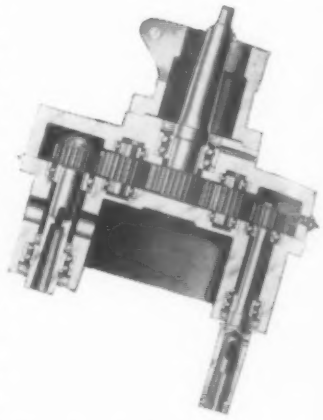
MARVEL ENGINEERING COMPANY
629 W. Washington, Dept. 31, Chicago 6, Ill.

. . . they don't yawn *anymore*

THEY couldn't see why we emphasize our rigid alloy requirements—controlled heat treatment—exacting machine work—all normal procedure in making gears for Thriftmaster Drillheads.

Then they ran into gear trouble in the heads being used in their own plants. Enforced work stoppages and reduced output sent costs soaring upward.

Then they began to listen. They let us prove what a soundly constructed drillhead with *hardened* gears and spindles can do. Now they specify Thriftmaster for all Multiple Drillhead requirements.



For complete engineering information, write to: Engineering Department, Thriftmaster Products Corporation, 1048 N. Plum St., Lancaster, Pa.

THRIFTMASTER
Multiple Spindle Drillheads

BOYAR-SCHULTZ PROFILE GRINDERS

Fast, Accurate CONTOUR GRINDING
IN THE TOOL ROOM . . . IN PRODUCTION

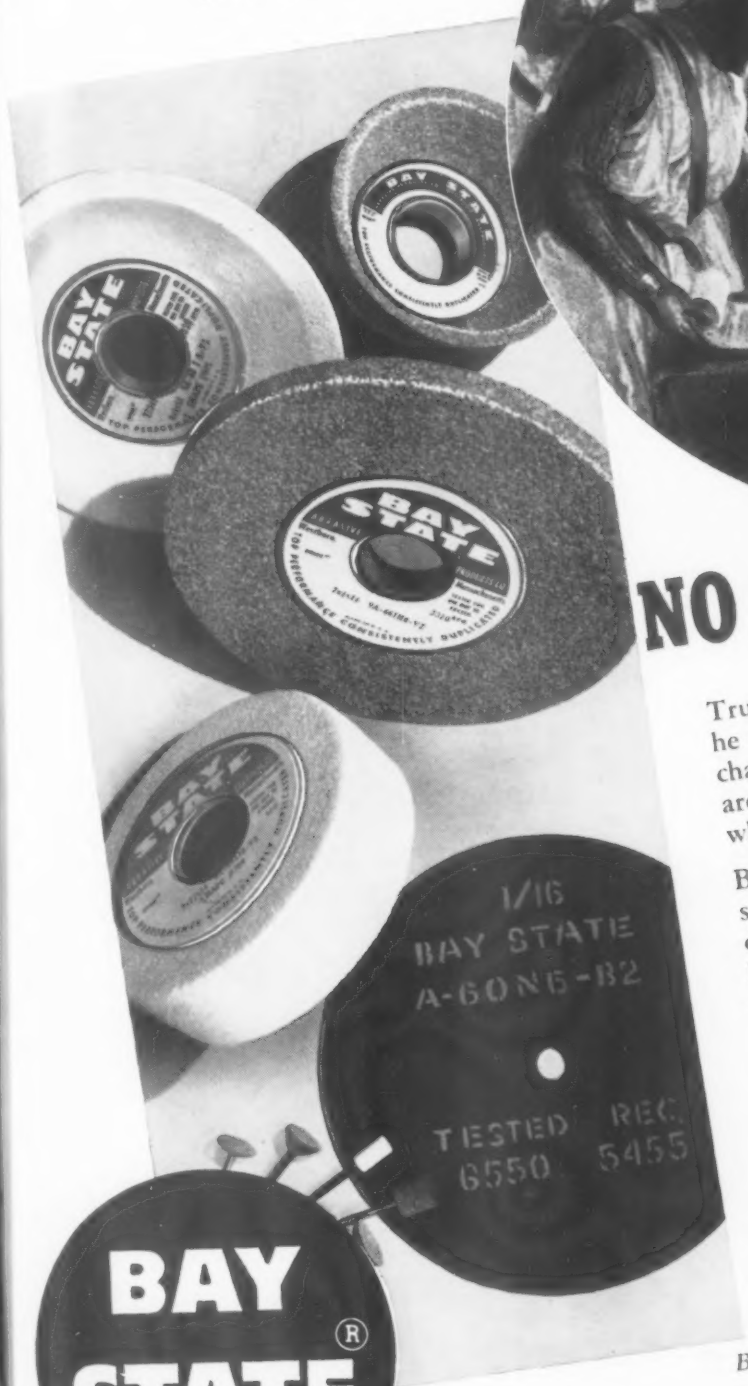
Boyar-Schultz Profile Grinders save time in grinding inside and outside contours, irregularly shaped profiles, die clearances and many other difficult grinding tasks.

Boyar-Schultz No. 2 Profile Grinder—A heavy duty floor model available with single or dual spindles which turn at 10,000 R.P.M. with vertical oscillations. Rapid stock removal even with wheels as small as $\frac{1}{2}$" diameter. Uses wheels $\frac{1}{2}$" to 3".

Boyar-Schultz No. 1 Profile Grinder—Bench model. Spindle speed of 20,000 R.P.M. with vertical oscillations. Accommodates wheels $\frac{1}{8}$" to 1" diameter. A highly efficient tool that performs in minutes, much of the work that formerly required hours.

BOYAR - SCHULTZ CORPORATION

King John of England being compelled to sign the Great Charter (Magna Carta) of liberties, in 1215.



NO OTHER CHOICE

True, King John had no other choice when he signed the Magna Carta . . . . but purchasing agents and toolroom men today are offered the widest choice obtainable when they select Bay State grinding wheels.

BAY STATE FRACTIONAL GRADES split every single normal grade into 3 degrees of hardness. Yes, this exclusive Bay State development enables you to make a more precise selection to get the best possible grinding wheel for any particular job.

If you aren't getting top performance from your present grinding wheels, it will pay you handsomely to investigate the possibilities of Bay State Fractional Grades.

Send for literature.

Branch Offices and Warehouses — Chicago — Detroit
Distributors — All Principal Cities

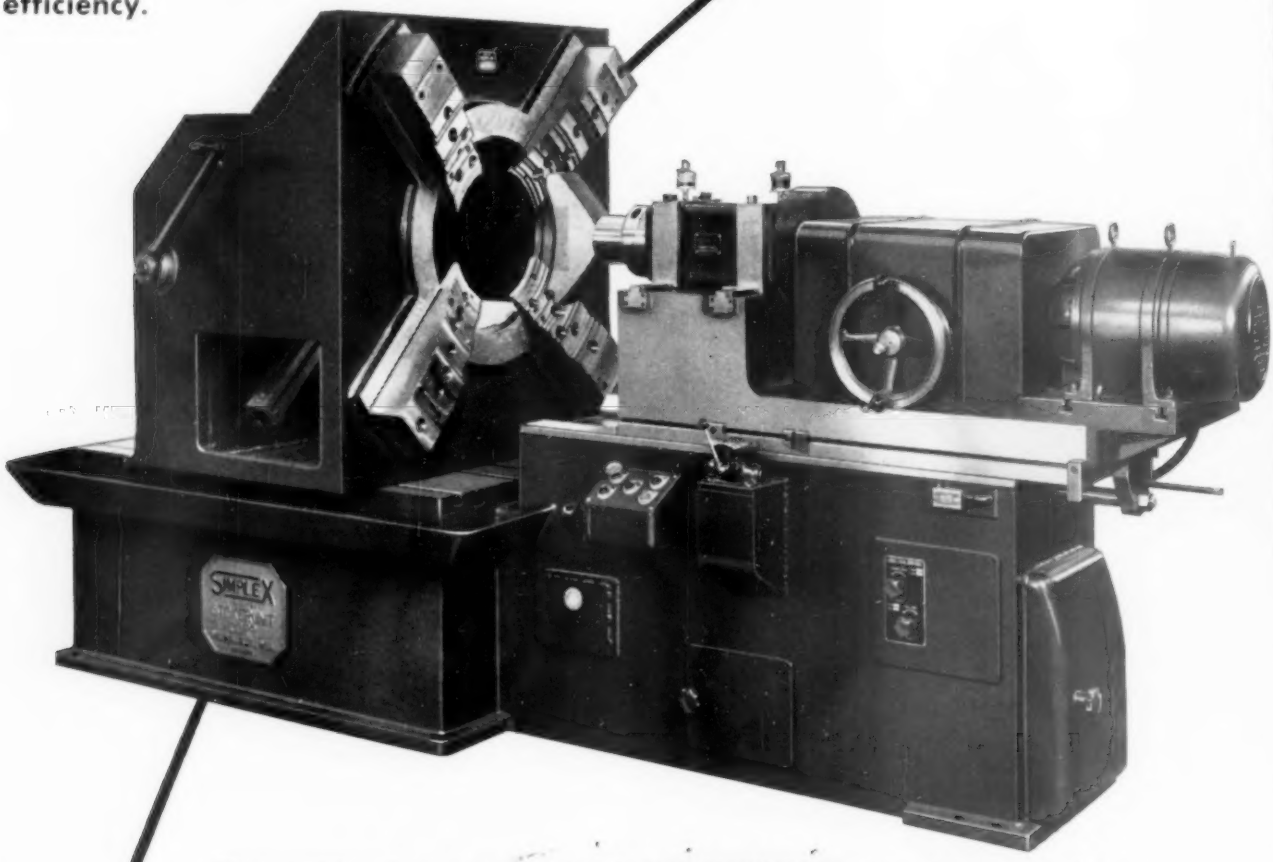
BAY STATE®

Top Performance Consistently Duplicated

BAY STATE ABRASIVE PRODUCTS CO., WESTBORO, MASSACHUSETTS, U. S. A.

SIMPLEX

ELECTRIC MOTOR END SHIELDS must support rotors rigidly and accurately, yet due to the lightness of the casting, they are usually distorted in machining operations. The precision boring operation on the bearing seat in a multiple step fixture eliminates the inaccuracies and provides for maximum motor efficiency.



The machine shown is a 4U Single-End SIMPLEX Precision Boring Machine with an enlarged work table, a raised gear-driven spindle and a variable speed drive unit to control the boring spindle speed. The fixture is of the quick-clamping, adjustable type locating the part from the previously machined rabbet surface. A wide variety of pieces can be accommodated in a single machine with a minimum of changeover time required from one size end shield to another.

Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Machine Tools Division

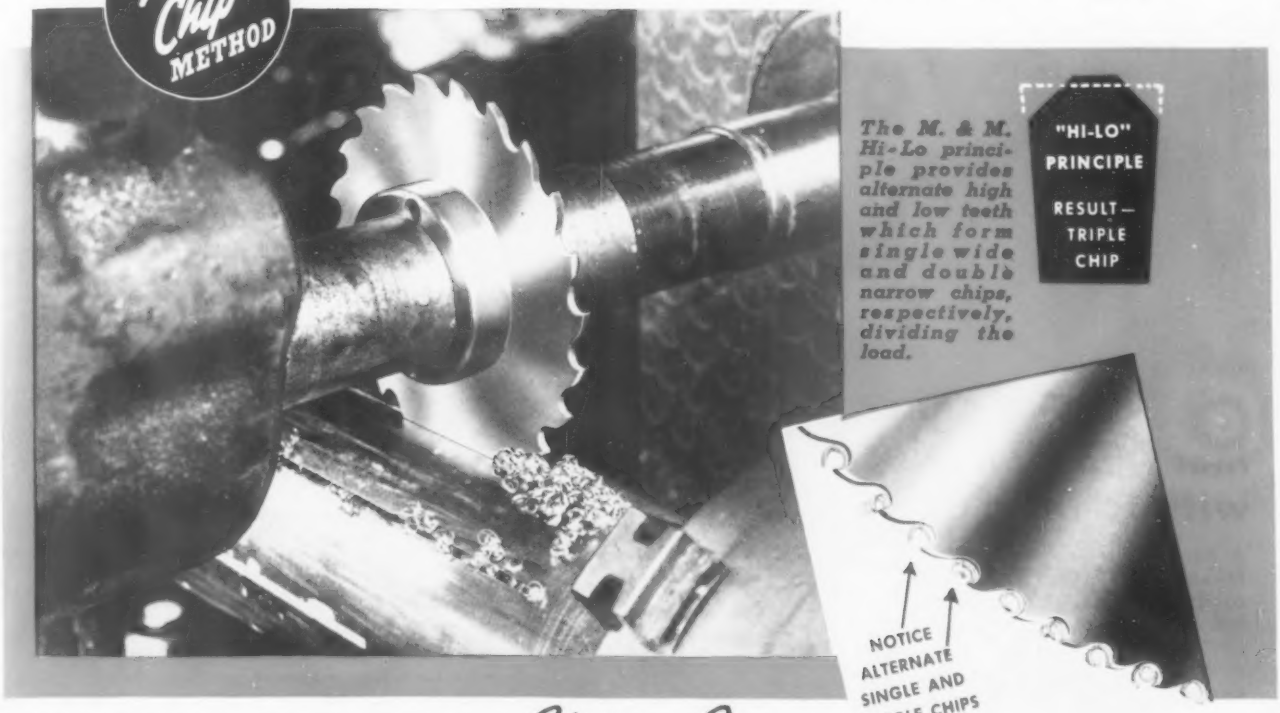
4528 West Mitchell Street, Milwaukee 14, Wisconsin

Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools

BREAK UP *Your Chip Loads..*

CASH IN ON FASTER FEEDS AND SPEEDS!

Triple-Chip METHOD


"HI-LO" PRINCIPLE
RESULT— TRIPLE CHIP
The M. & M. Hi-Lo principle provides alternate high and low teeth which form single wide and double narrow chips, respectively, dividing the load.
NOTICE ALTERNATE SINGLE AND DOUBLE CHIPS

MOTCH & MERRYWEATHER *Slitting Saws*

GIVE GREATER SPEEDS AND LONGER TOOL LIFE

Motch & Merryweather's original dual drive equalizes stresses, gives plenty of driving power, and makes blade keyways unnecessary

M. & M. Slitting Saw Blades enable you to profit from record-breaking speeds and satisfying accuracy. They give you all the well known advantages of the Triple-Chip Method. The characteristic M. & M. curved, cam-generated tooth contour avoids clogging, since the curling chips are self-clearing. A generous gullet imparts great strength to the teeth. Result: faster cutting, longer blade service.

Exclusive dual drive design supplies positive driving power and protects the driving means; practically no blade breakage. Blades adaptable to arbors up to 1¼"; interchangeability conserves blade investment. Range of pitch in all diameters and thicknesses. Other big advantages, too.

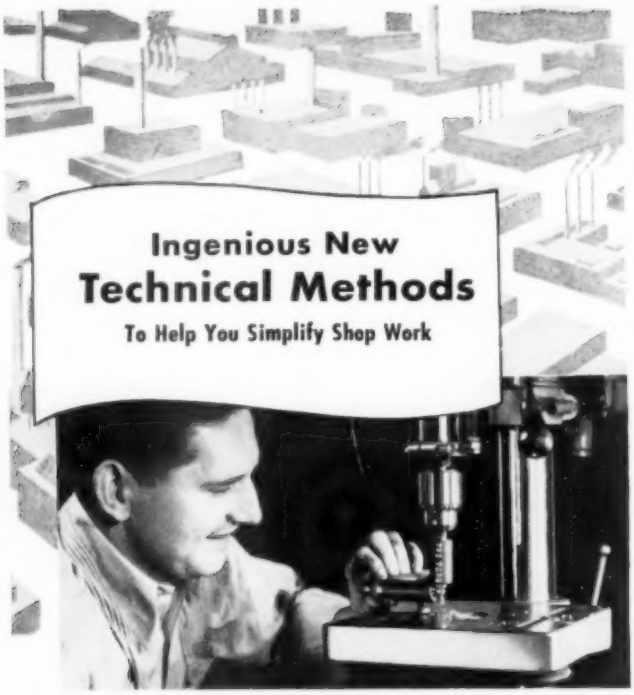
Get well illustrated Bulletin "T-2"

Only M & M builds ALL 3: CIRCULAR SAW · SAW BLADE · BLADE GRINDER

THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING • CLEVELAND 13, OHIO

CUTTING TOOL DIVISION

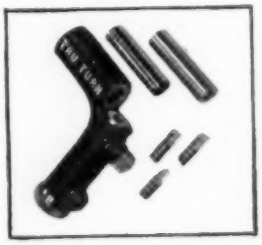
AT YOUR COMMAND · AN UNPARALLELED EXPERIENCE IN CIRCULAR SAWING



Metal Turning Made Easy with New Simplified Tool!

A new tool called "Tru-Turn" makes possible the conversion of drill presses, woodturning lathes, or grinder stands into tools that will turn and cut-off steel, bronze, copper and aluminum. The "Tru-Turn" tool shown above is mounted on a Buffalo Drill Press, Spindle Size.

The "Tru-Turn" tool is easy to operate and cuts and turns bar stock of steel, bronze, copper and aluminum measuring ¼", ⅜" and ½". Its built-in micrometer permits adjustments that give tool-room accuracy to 1/1000 of an inch.



Tru-Turn Tool

Small tool shops as well as all types of repair shops and garages find the "Tru-Turn" ideal for cutting long pieces of bar stock into desired lengths. Also, home craftsmen are able to produce accurate, highly finished precision-machined parts from metal even without previous training.

Accurate, precision work is also easier to do when tension is relieved by chewing gum. The act of chewing seems to make the work go easier, faster —thus helping on-the-job efficiency. For these reasons Wrigley's Spearmint Chewing Gum is being made available more and more by plant owners everywhere.

You can get complete information from Millholland Screw Products Corp., 132 West 13th Street, Indianapolis 2, Ind.

AC-57

SAVE ASSEMBLY TIME

SPECIFY UNBRAKO KNURLED

Reg. U. S. Pat. Off.

HEAD CAP SCREWS

They speed assembly because their knurled heads provide a slip- and fumble-proof grip—be the fingers and heads ever so oily—therefore, they can be screwed-in faster and farther before it becomes necessary to use a wrench. Their internal wrenching feature facilitates compact designs, so space and weight are saved and cost reduced. Millions upon millions of these time-savers—in sizes from No. 4 to 1½" diameter and in a full range of lengths—are being used throughout industry. Write for the "Unbrako" Catalog.

Fig. 1434

"Unbrako" and "Hallowell" Products are sold entirely through Industrial Distributors

We'll see you at our booths 324, 326, and 328, at the A.S.T.E. Show.

You can't tighten or loosen socket screws without a hex socket wrench, so why not get our No. 25 or No. 50 "Hallowell" Hollow Handle Key Kit which contains most all hex bits.

Kits: Pats. Pend.

Knurling of Socket Screws originated with "Unbrako" in 1934.

OVER 45 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PA. BOX 786

BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

Universal Floating Collet Chucks

FOR VERTICAL OPERATION

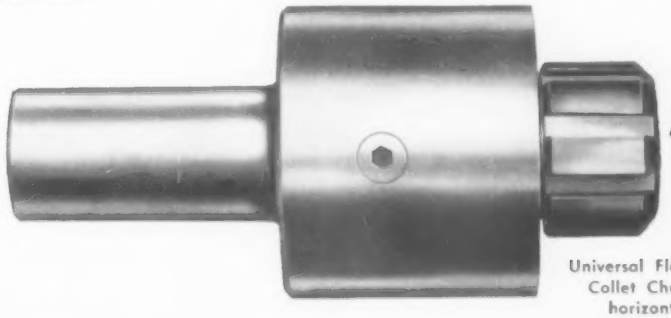
FOR HORIZONTAL OPERATION

Universal Floating Collet Chuck for vertical operation.

The *most sensitive floating action of any chuck on the market today* is engineered into Universal Floating Collet Chucks. That means you can perform more accurate reaming, counterboring, and tapping operations in less time and with less effort.

When used in a horizontal position, the Universal Floating Collet Chuck may be brought to the *center of the work in minimum time* by adjusting flat springs to precisely counterbalance tool weight. Both driving and thrust loads are carried by an *interlocking assembly of frictionless bearings,* hence there are no auxiliary bearings to increase friction or resistance or otherwise restrict the positive floating action. A new type seal *permanently prevents entrance of coolant into these chucks,* so that cutting compounds may be used to permit higher speeds and heavier feeds.

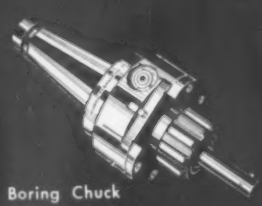
For greater accuracy and efficiency in your production, it will pay you to use Universal Floating Collet Chucks. Write for complete information.



Universal Floating Collet Chuck for horizontal operation.

UNIVERSAL TOOLS THAT WILL INCREASE PRODUCTION AND EFFICIENCY IN YOUR PLANT

Index Plunger



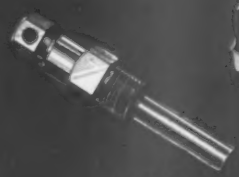
Boring Chuck

Standard Collet Chuck

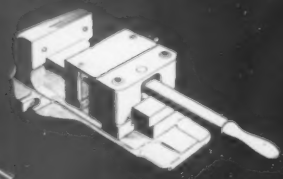
Mikro-lok Boring Bar

Floating Chuck

Standard Drill Bushing

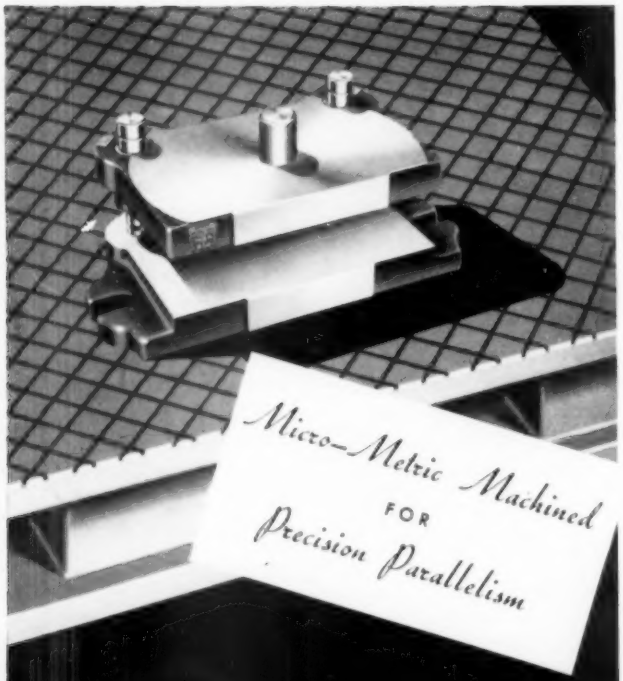


Grippit



Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY • **FRANKENMUTH, MICHIGAN**



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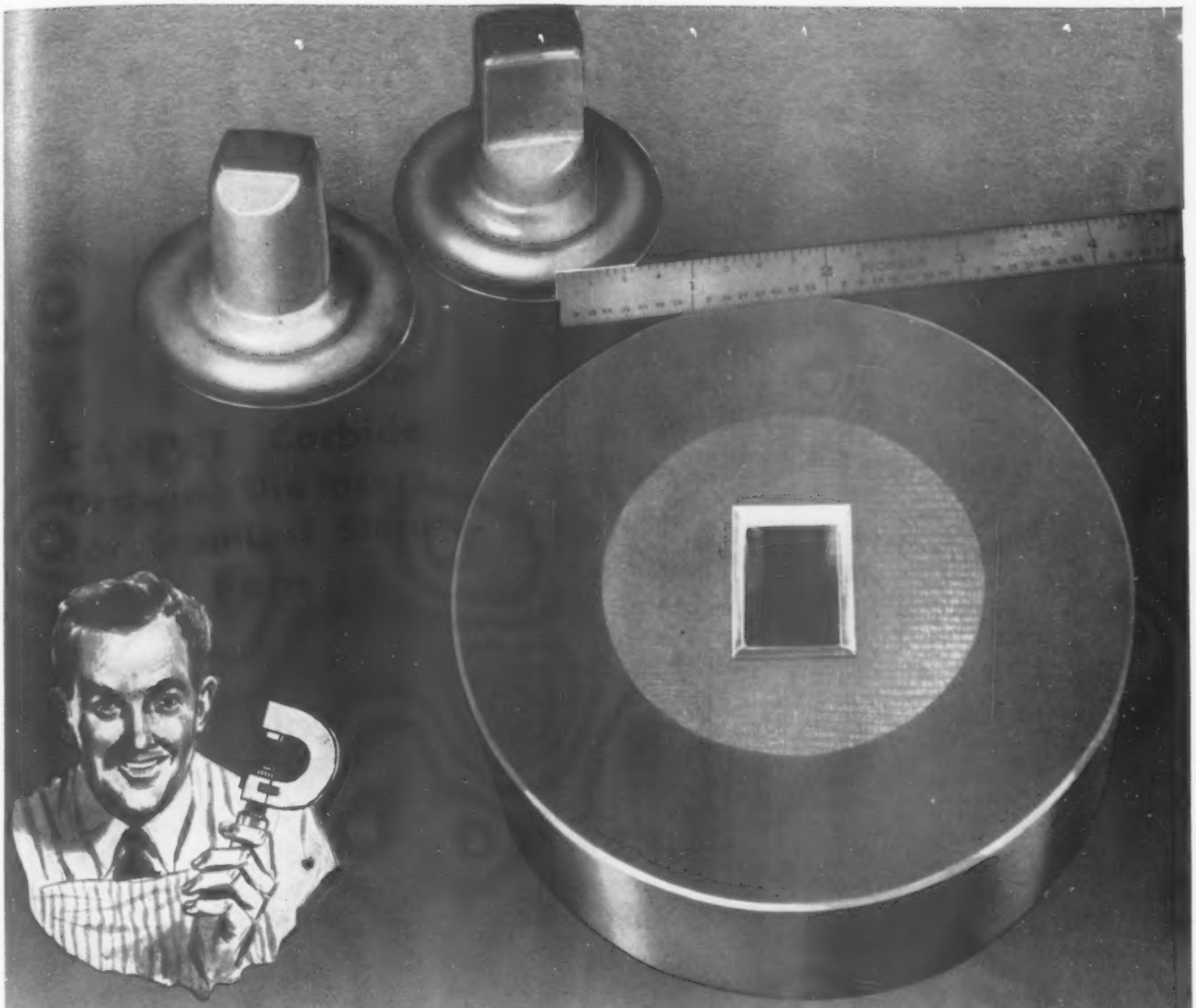

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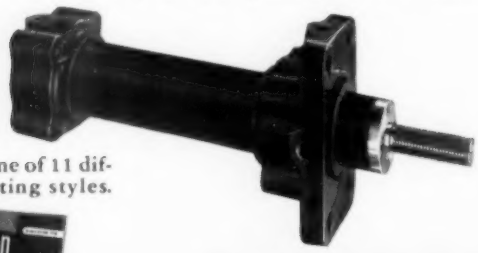
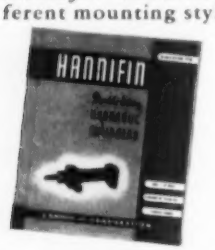


Model JN—one of 11 different mounting styles.



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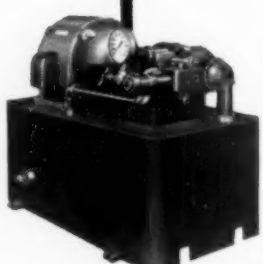

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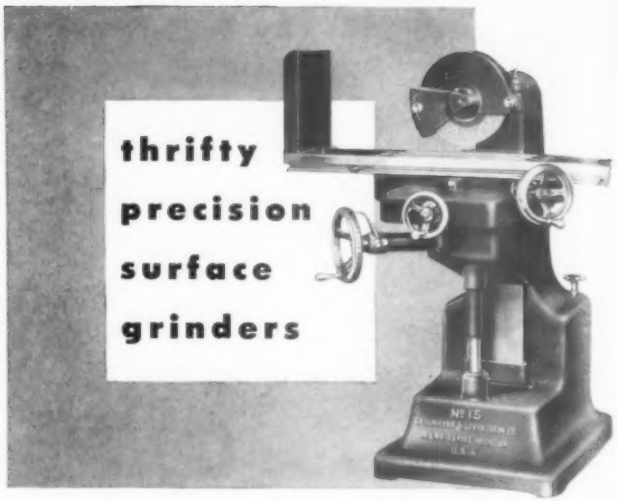

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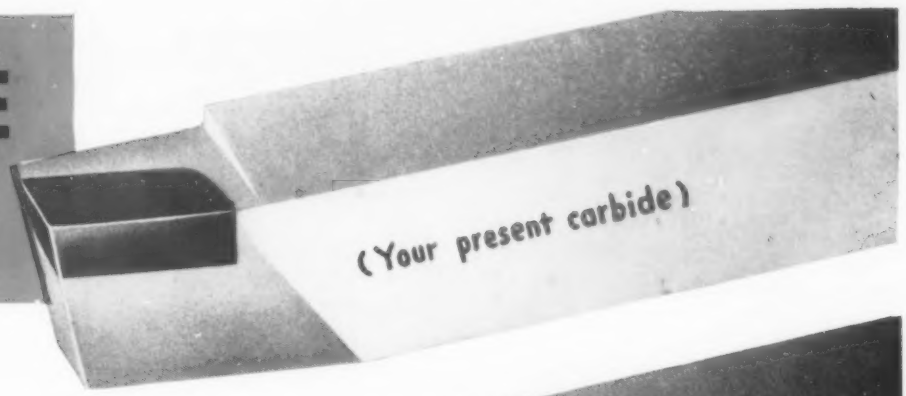

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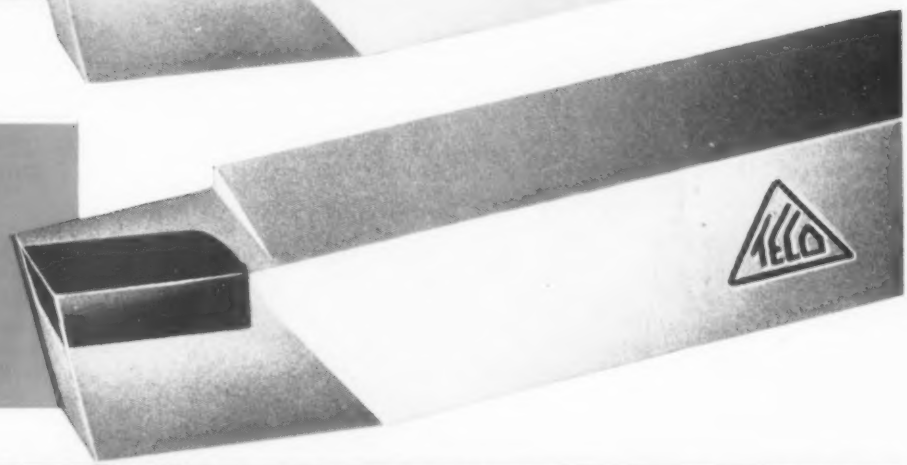

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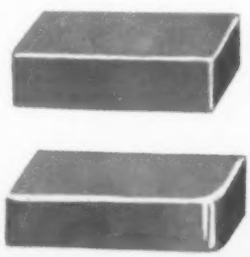

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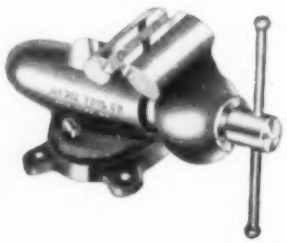

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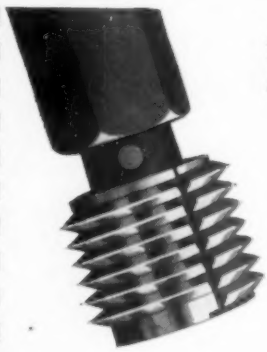

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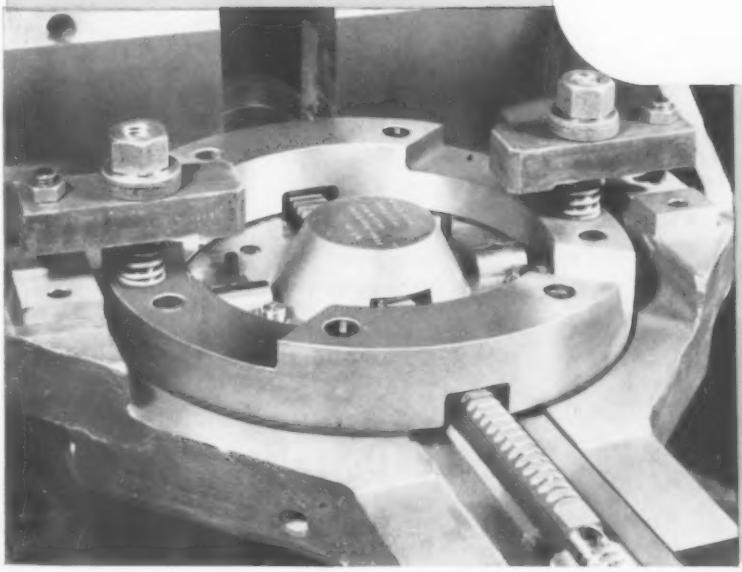

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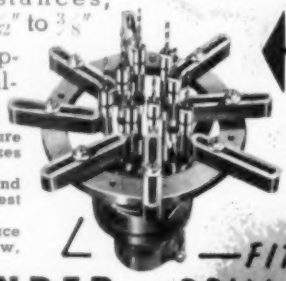

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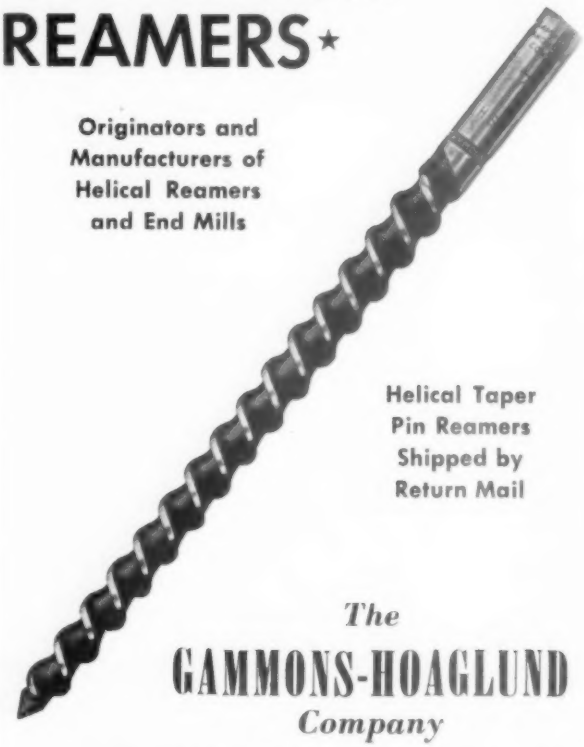

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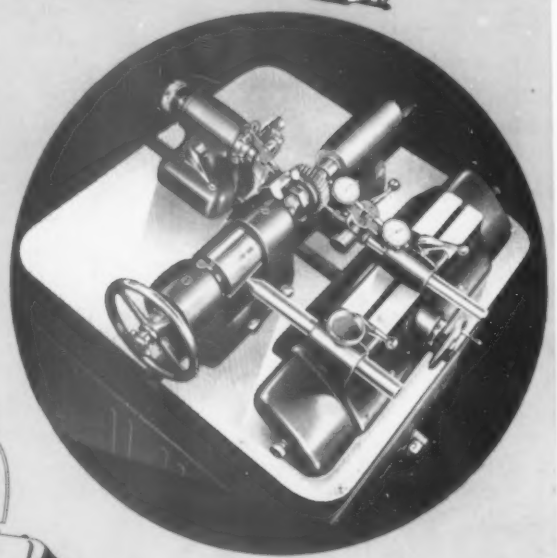

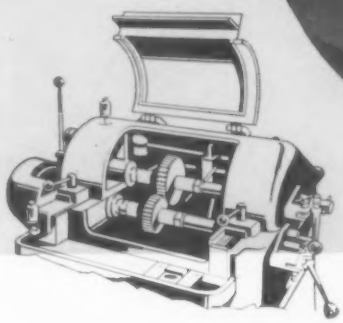

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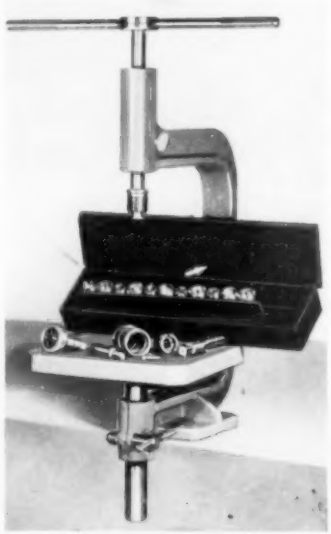

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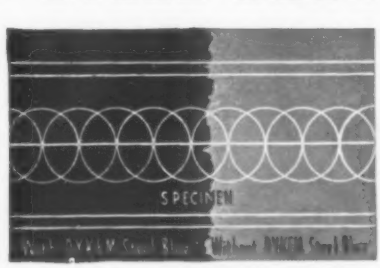

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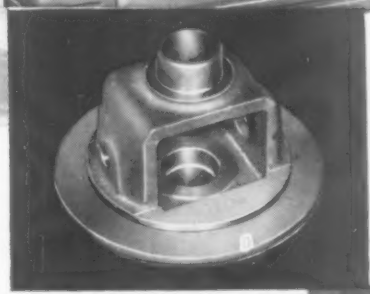
Note typical use of an Ex-Cell-O Way Machine to the right. Send for catalog with many varied applications—ask for Bulletin No. 31631.



Above: Ex-Cell-O Four Way Precision Boring Machine. The four way units are electrically interlocked and controlled from the push button station on the right front unit. *Left:* Malleable iron differential case in which two inside counterbores are finish bored and chamfered and two cross holes are bored.

Right: Close-up view of part in fixture and boring spindles. Note that boring bars on left front and right rear spindles are carried on tool slides that are retracted to allow tools to enter holes, are moved out to finish inside counterbores, and again retracted for withdrawal.

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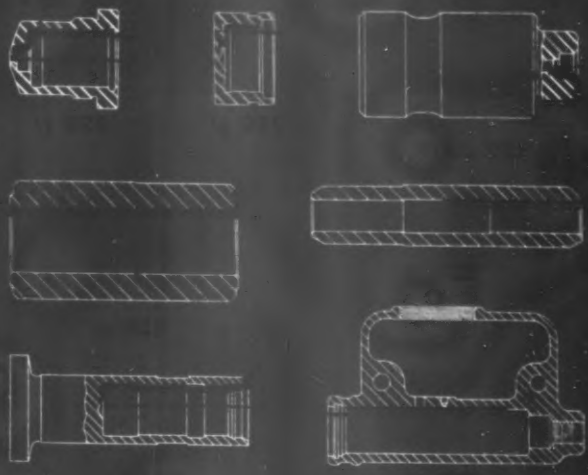

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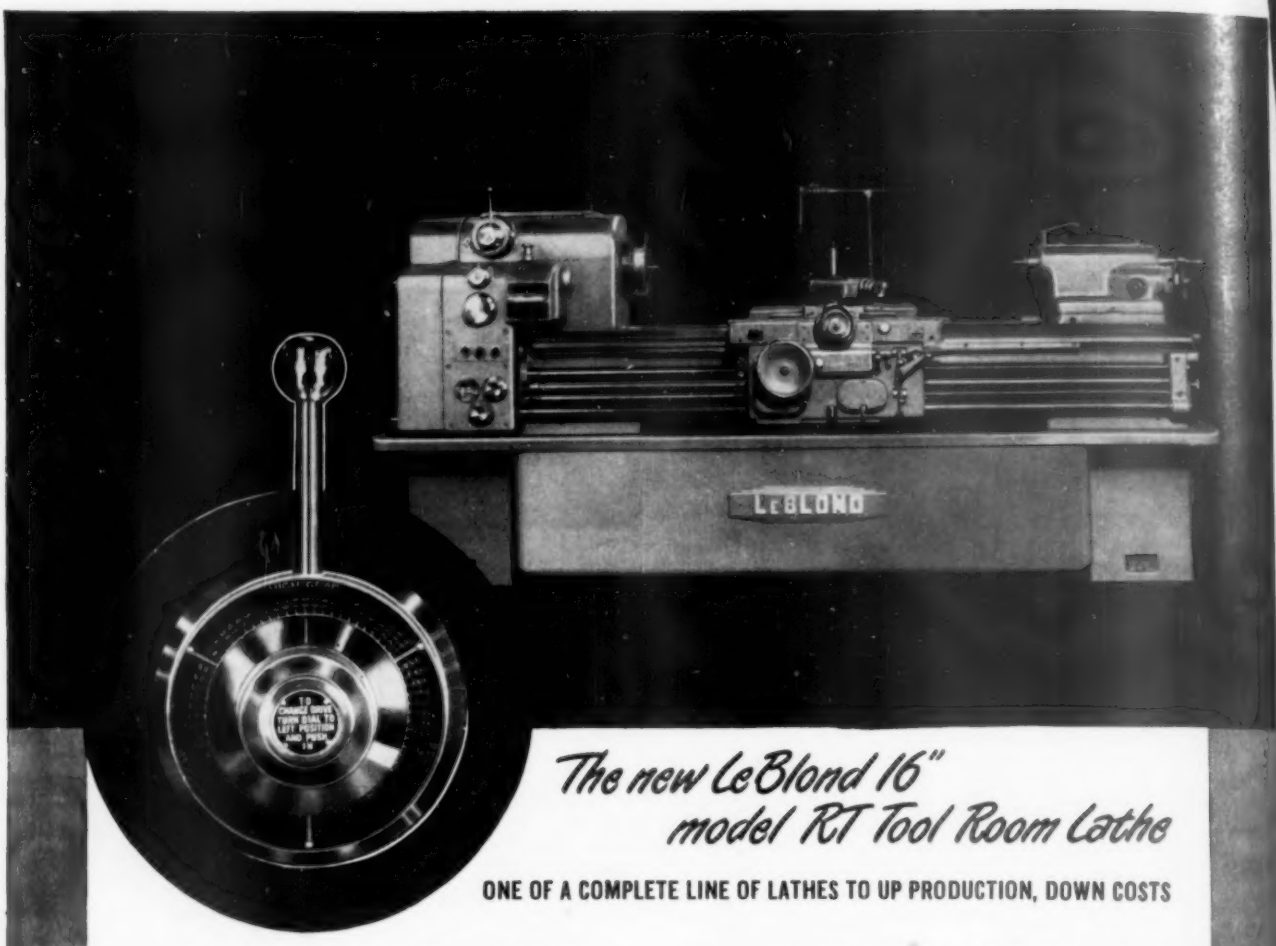

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